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Translations

MEMORIAS
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Contribution to lhe study of the brazilian Trypaneidae or fruit-flies

by

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With plates 1 and 2.

In the preceeding portuguese paper the authors discuss the specimens of *trypaneidae,* found in the collections of the institute of Manguinhos and of the museum of natural history in S. Paulo, and describe some species and varieties.

The most important form is the *Anastrepha (Dacus) fraterculus,* described by WIEDEMANN in 1830. He included it in the genus *Dacus,* LOEW in *Trypeta* and SCHINER in the genus *Anastrepha,* established by him and now generally accepted. It is known to exist in Mexico, Cuba, Porto Rico, Peru, Brazil and Paraguay, where it is extremely injurious to guavas and peaches. It has also been found in the fruits of *Passiflora quadrangularis* and the recently introduced *Diospyrus kaki* from Japan.

The species is evidently a very variable one. Several of the forms, described as new species, are likely to be only varieties. This applies to *A. suspensa, ludens, hamata, integra, consobrina* and *pseudo-parallela* of LOEW, *obliqua* MACQUART and perhaps *peruviana* of TOWNSEND. Even *parallela* WIEDEMANN, though apparently differing in size and direction of the long veins (as pointed out by LOEW), is connected by intermediate forms.

Variation occurs principally in the design of the wing, composed of three, mostly brown, bands: a short one in the basal half of the fore margin, another in the shape of an S, running obliquely through the wing, and a third one, like an inverted V, situated near the apex and beneath the second one. They are interconnected or partially obliterated in varying degrees. The different forms are not geogaphical varieties, as they often occur in very distant regions.

The specimens examined represent five new types; four: Var. A, B, C, D, correspond to the types of WIEDEMANN, LOEW, VAN DER WULP and BEZZI and one is similar to

var. *soluta* BEZZI. The different forms are illustrated by reproduction of the drawings (found in the papers of these authors) and of the wings in the present specimens (from microscopical preparations). Size, habitat and dimensions of these are carefully given.

The study of all these forms leads to the conclusion, that the exemple, given by LOEW (who founded new species on small differences), ought not to be followed. There is only one specimen not connected with the others by intermediate forms. Of this the authors give a description, calling it: *A. fenestrata.* It comes from the Amazon and may be a new species or only a rather aberrant variety.

All these considerations seem unimportant by themselves, but they are of interest for the questions of the fixity of the existing species and the formation of new ones.

There is another indigenous species of *Anastrepha,* the *serpentina* WIED., injurious to *Mammea americana* L. and *Sapota achras* MILL., as verified by HERRERA and TAVARES. COSTA LIMA bred it from *Lucuma cainito* A. D. C. and *Mimusops coricaea* MIQ. The synonymy and a photograph of the characteristical wing are given (Fig. 20).

Of the genus *Hexachaeta* LOEW (1873) one species, described by WIEDEMANN (1830) as *Trypeta eximia,* was also observed in two specimens from near Rio; they show a tendency to varying. Synonymy, descriptions and a photograph of the wings are also given.

Follows a discussion of the genus *Plagiotoma* LOEW (1873), with a key for the described and new brasilian forms. So far as it is known, the first stages of these flies are found in galls of composites of the genus *Vernonia,* as verified by LOEW, R. V. IHERING and the authors. Two forms of LOEW, *biseriata* and *obliqua,* were found in Brazil and the authors describe three more, differing in the number of black dots on the apical end of the notum and also in the design of the wings, as shown by photographs. However the question, if those different forms ought to be considered good species or only varieties, remains open and may be solved by rearing more specimens.

The authors then give a catalogue of the genus *Apyrgota* HENDEL (1913), subfamily *Pyrgotinae.* They describe a new species, *personata,* which might be mistaken for a *Trypeta.* A catalogue of the genus *Anastrepha* with synonymy and litterature ends the paper.

An index of the litterature consulted and an explanation of the plates follows the portuguese text and might be consulted there.

Protozoa parasitical on "Polydora socialis"

by

Drs. GOMES DE FARIA, MARQUES DA CUNHA and O. DA FONSECA.

(With plate 3.)

Various authors have noticed marine worms boring galleries in the shells of marine mollusks, dead or alive, and using them for shelter. While studying the development of *Ostrea parasitica* at the now extinct marine biological station, we frequently observed polychaetic worms in their shells; one of them, which was always found in holes, dug in the under shell, was determined as *Polydora socialis*. At first we were only interested in studying the worm and only later we discovered the species of protozoa living in its intestine, which form the object of this paper.

The material for this investigation was not restricted, as oysters with parasites were easily obtained from fisheries near to the Praia da Saudade (in the bay) and also on the fishmarket and at the hotels of Rio de Janeiro. At first we extracted the *Polydora* by mecanical means, opening the holes carefully with a scalpel, but this process proved very laborious and required the greatest care, in order to prevent the instrument or pieces of the shell from fatally injuring the very soft tissues of the worm. By numerous trials we obtained only one or two intact specimens. Afterwards we were informed of an interesting method, due to CARAZZI (1), who uses a 1 or 2‰ solution of chloralhydrate in sea water; after a few hours contact of this solution with the shells, the polychaetic worms come out of them, sometimes in very great number.

In the "Brazil–Medico" (2) we gave a preliminary note describing shortly two species of parasitical protozoa, found in the examined specimens of *Polydora*. More recently we also noticed frequently a gregarine of the genus *Doliocystis*, belonging to a species we could not determinate. Of this we only give a figure, while the description of the two other species forms the principal part of this paper.

1) Mittheil. d. zool. Stat. zu Neapel, Vol. 11,
2) Brazil—Medico, an. 31, n. 29, pag. 243).

Anoplophrya polydorae FARIA, CUNHA and FONSECA, 1917.

This protozoon is a ciliate of the suborder *Astomata* and belongs to the genus *Anoplophrya* STEIN.

Description: Body flattened, the outline oval, one side concave, the other convex, anterior end smaller, posterior larger. Cellular membrane showing longitudinal striae starting from both poles of the animal; as these approach the middle part of the ciliate, new lines appear between them, filling up the intervals, so that the distance between two successive striae remains nearly equal. These striae are occupied by several rows of ciliae, which are fine, equally long, and arranged closely and regularly on the entire surface of the body. Ectoplasma forming a narrow hyaline layer, equally disposed beneath the cellular membrane. Endoplasma finely granulated. Macronucleus forming a long and thick rod, dilated at the ends and sometimes undulating; it runs, longitudinally and some times a little obliquely, through nearly the whole body. Micronucleus spindleshaped, generally far from the macronucleus and near to the cellular membrane. On each side of the macronuclens a row of (generally three) vacuoles, all of them appearing spherical but varying in size.

Dimensions: About 85: 65 *micra.*

Habitat: Digestive tract of *Polydora socialis.*

Selenidium cruzi FARIA, CUNHA and FONSECA, 1917.

This gregarine belongs, in our opinion, to the suborder *Schizogregarinae,* though we never observed the forms of multiple division, characteristical of this suborder; taking in account the form of the trophozoite, we include it in the genus *Selenidium* GIARD.

Description: — As mentioned before, our description is limited to the forms of the trophozoite, as we did not meet with any other stage in the evolution of this organism.

Trophozoite elongated, slightly flattened, vermiform and longitudinally striated by myonema fibrils, about eight on each face. Anterior end less attenuated than the posterior one and provided with a short epimerite.

Nucleus stretched in longitudinal direction, situated in the middle of the body and showing, in one of the ends, a caryosome, in which a centriole is sometimes perceived.

Near the caryosome we sometimes find a small granulation, very rich in chromatin, which is likely to represent the centriole, emigrated from the interior of the caryosome. Nearly all the chromatin is accumulated in the caryosome.

Dimensions: 100-160: 15-25 *micra.*

Habitat: Digestive tract of *Polydora socialis.*

A new human mycosis.

A study of the morphology and biology of "Oidium brasiliense", n. sp., the etiological agent of a new human disease.

by

Dr. OCTAVIO DE MAGALHÃES

(With plates 4 to 14).

In preliminary notes, published in the "Brazil-Medico" of September 29 and October 22 1914, we mentioned some characteristics of the agent of this new human mycosis.

In later numbers of the same journal we enumerated the chief differential characters of the new disease, and stated, as a result of several observations, the curability of this disease by iodides. In order to fulfill our promise, we now proceed to give more details about the fungus.

While director of the laboratory of the hospital of Bello Horizonte, we examined daily several sputa by various processes. In the course of 1912 we isolated from the sputum of a patient, whose observation we only obtained much later, a fungus, the biological characteristics of which allowed us to consider it a new species and to include it into the family of the *Oidiaceae*. The request was labelled "research of the bacillus of Koch". The negative bacterioscopic result induced the chief of the clinical department to make a new request, this time with the observation "that it was a typical clinical case of pulmonary tuberculosis, in full secundary evolution".

It is hardly necessary to state that the new researches, this time not only bacterioscopic but also microscopical (homogenisation, inoculations etc.), were always negative. On the other hand, new cases with the same clinical symptomatology and similar result of microbiological researches appeared after our attention had been roused. Careful and long lasting studies, continued for more or less 3 years, showed the high pathogenic power of the isolated fungus. The animals, after any form of inoculation, all died, within a varying lapse of time, with the same lesions, from which we succeeded nearly always in again isolating the parasite.

Two facts called our special attention, forming, so to say, the starting point of our studies.

The first was noted when, by advise of Dr. OSWALDO CRUZ (then in Bello Horizonte), we infected 5 small monkeys *(Hapale penicillata)* by mouth and nose, without scarification of the membrane. These infections produced a disease, the clinical evolution and aspect of which remembered the human pulmonary tuberculosis. All the five monkeys died and we found many parasites in the organs, especially in the lungs. The infection of small laboratory animals with the fungus threw little light on the evolution and the symptomatology of the experimental disease. As a rule, the clinical syndrome in these small animals is changed or altogether wanting. Also thir death does not always allow definite conclusions. All laboratory students know the errors, which not only might be induced by intercurrent diseases, but also by other germs than the specific ones of the human lesions. These accompanying germs of the human lesions may prove pathogenic for small animals, as shown by many examples, specially amongst the fungi.

The second fact was the tendency of the parasite to localisation in the lungs. Animals, in other ways resistant, when inoculated with cultures, for instance in the muscles, showed only lesions of the lungs. Only here could we recover the parasite, and, it was not even possible to discover any abnormal sign at the point of inoculation.

All these facts, once well established, led us to expect that an autonomous symptomatology might be attributed to the presence of the *O. brasiliense* in the sputum of man and we found that we were not mistaken.

We now proceed to study the Oidium brasiliense:

1. as to its systematical position;
2. in natural conditions;
3. in artificial cultures;
4. in animals;
5. in man;
6. in the tissues with a short report on the pathological anatomy and also the
7. diagnosis
8. etiology } of the human disease
9. treatment

The limitation of exact and positive notions in the chapter "mycoses" of human pathology oblige us to enter into details, which, in other cases, might be unnecessary. We do not pretend to determine, with mathematical precision, the class or sub-class of this new fungus. Mycology is not yet much advanced and the classifications, published up to date, are incomplete and deficient; hence the necessity, in this kind of study, of entering into minute and even fastidious details.

The nature of the parasite.

The biological and morphological characteristics of this parasite differ from those of all the described fungi. The question of pulmonary mycosis has been approached long ago by several authors. SACCARDO mentions that in 1842 BENNET gave to a certain parasite, found in the sputa of patients with pulmonary disease, the name of *"Oidium pulmoneum"* (see, for more details, the chapter on diagnosis). There is nothing positive in this assertion, except, perhaps, the confusion of this species, which the recent mycologists include in the genus *Mycoderma* (VUILLEMIN, 1891). The *Endomyces* too have been charged with similar offenses. The studies of CASTELLANI, especially those made in Ceylon (1911 and 1912), bear witness to this kind of parasitism. It is a pity that the studies of this author should be a little deficient. On the other hand, north-american publications also denote mycotic affections of the lungs caused by yeasts, not to speak of the *Aspergillus, Sporotrichum, Leptothrix, Blastomyces, Discomyces,* etc., described in Japan, Europe, North America and Brazil. Of all these *fungi,* however, only the *Endomyces* and the yeasts interest us, on account of related biological and morphological characteristics. The other ones may be easily separated by the evidence of contrasting features. The likeness with the yeasts is, however, superficial. The initial forms of

the *Oidium brasiliense*, in the artificial cultures, are in fact yeast cells and are alike or similar to those we find in the tissues and in the sputum. This aspect of the parasite is not at all strange, as we know it to be an *Oidium*.

The photographic prints, which accompany this paper, show the mycelian form of the fungus. They are true mycelia, not pseudo-mycelian forms, while yeasto—not in the old sense but according to modern mycology—are unicellular fungi "which in no stage of evolution show true mycelia" (GUILLIERMOND). Besides, there are biological characteristics, which include them into the *Ascomycetes*.

The *O. brasiliense* is also by no means the first example of a fungus, which, while developping normally in mycelian form, presents, at a given moment of its life-cycle, only yeast-forms. This morphological duplicity, though characteristical for the family of *Oidiaceae*, may be found elsewhere, as shown by the *basidiospores* of some *Basidiomycetes*.

There is, also the classical exemple of "*Dematium pullulans*".

This *fungus* with highly differentiated mycelium may, in certain conditions, multiply exclusively by yeastforms. The adaptation to the new form is so complete, as to make it difficult to again obtain a mycelium. In this special case we observe in microscopical morphology, what SABOURAUD noted in the macroscopical morphology of certain *tineae*. The pleomorphous forms of the *Trichophyta* undoubtedly mav become constant in certain media of culture, but these facts are still liable to new interpretations. The outer aspect of the cultures alreadv helps to distinguish it from the *Endomyces albicans*. On potatoc for instance, the *Oidium brasiliense* gives dry, mealy and distinctly wrinkled cultures. The *Endomyces* gives humid, viscous cultures without wrinkles. To the difference in macroscopical morphology corresponds an evident divergence of the microscopical morphology. On potatoe the *Endomyces* gives, as a rule, yeast forms which are prevailing in the preparation (smears etc.). The contrary happens with the *O. brasiliense*, in the potatocultures of which the mycelian forms prevail. The table of fermentations, given at the end of this paper, also furnishes a good standard of palpable differences. This table may be compared with that given by CASTELLANI in the "Journal of tropical Medicine" of 1911. For establishing his table of fermentation this author studied 13 varieties of *Endomyces albicans*.

We abstain from further comment.—The creosote medium does not furnish any positive information, as regards the differentiation of the *Endomyces albicans*, in spite of the assertion of some authors. It is a mistake to declare it impossible to obtain cultures of this parasite in a medium with creosote. All depends on the percentage of this substance in the artificial medium. With 0,5 % we failed to obtain the culture, but with 0,01 % we got good cultures of *Endomyces albicans*. The same is true for the "*Oidium brasiliense*". The *Oidium brasiliense* differs also from the *Endomyces* in the cultures on carrot, agar, (2 %) gelatine, SABOURAUD with maltose, and, chiefly, on alkaline and acid media.

The studies of VUILLEMIN also show the nature of the *Endomyces albicans*. In old cultures of this fungus the author found *asci* and, therefore, rightly included it in the *Ascomycetes*. We never found *asci* in the cultures of the *Oidium brasiliense*, nor even in the artificial cultures of GORODKOWA. Any doubt, still remaining, is dispelled dy the high pathogenic power of the parasite under study. The bucco-nasal inoculation by painting the mucosa without scarification is sufficient for killing monkeys or rabbits. All the common laboratory animals are sensible to the *Oidium brasiliense*, whatever way of inoculation may be used.

The inclusion of the *O. brasiliense* into the *Oidiaceae* can only be appreciated after reading this paper to the end. We recommend the lecture of the paper of GOUGEROT & VAUCHER (1910), as it is impossible to resume it here.

Natural occurrence.

Our researches did not give any definitive solution of this question. The cases of amygdalitis, laryngitis and pharyngitis, in which we succeeded in isolating the parasite, lead us to the belief that its forms of resistance exist freely in the natural surroundings. Expelled with the sputum by coughing and imbedded in certain substances, it may live in the form of spores till, coming in contact with the tonsils, the pharynx, the bronchial tubes or the intestine, it may develop and multiply under favourable conditions.

We already began researches for elucidating this obscure side of the disease. We do not believe, however, that for the *O. brasiliense* there are intermediate hosts in the actual signification of the word: at best, perhaps some reservoirs of virus, as for the species of Sporotrichum (GOUGEROT). Scrapings of ulcers, pus, skin, sections, scales, etc. never gave us cultures of the *O. brasiliense.*

Artificial cultures.

Macroscopical aspect.

When first isolated from the sputum or from the lesions with the precautions, necessary for such cultures, the *Oidium brasiliense* presents an unequivocal general aspect, which always is quite the same. The best medium for the development of the parasite is *Sabouraud with maltose* in laboratory temperature. After 48 hours of growth in a balloon of ERLENMEYER, the culture presents, in this initial stage, with its dirty gray colour and light cover of white down, a chamois-like aspect, looking like a fine net piled up, without a rim and elevated in the center of the culture. Slightly humid in the beginning, it soon becomes dry in the succession of days. In first instance the folds become more accentuated, the filaments (fructification of the culture) and the velvety and tomentous aspect prevail more and more, and give an unmistakable aspect to the culture. There is a manifest regularity in the distribution of the folds and the fluffyness. The culture increases in size and may attain the borders of the artificial medium.

Potatoe.

After 24 or 48 hours the stroke cultures show the crinkling of the surface, which, a little later, is covered by a whitish and mealy film similar to very small hairs. The culture has a velvety aspect. After some time a thick pellicle appears on the water of the tube.

Carrot.

The culture is already exuberant after 24 hours. One of our plates gives an exact idea of its appearance. It is dirty yellow, with velvety aspect and very wrinkled. In the course of evolution the folds become accentuated and distant, being high and numerous. Some folds are so elevated, as to touch the inner wall of a tube with a circumference of 3-4 centimeters. These cultures are very apropriate for the diagnosis and the study of certain mycelia.

The water of the tubes of these cultures contains abundant mycelian elements of various aspect and is covered by a brownish pellicle.

Milk.

The coagulation begins on the sixth day. Complete coagulation on the 12th day without change of colour.

Simple gelatine.

Liquefaction within 12 or 14 days with formation of a thick darkbrown pellicle at the surface.

Sabouraud with creosote (0,01 %).

Development retarded. The old cultures resemble those on *Sabouraud with maltose.* We call the readers attention to these cultures. When a higher percentage of creosote is added, the parasite does not grow.

With 0,5, 0,1 or 0,2 % there are not even traces of development of the parasite.

With progressively diminishing quantities of creosote, we find a pretty good development in the culture at 0,01 %, and this development becomes still more acentuated when the percentage of creosote is yet smaller.

Agar with sugar (2 %).

The development is marked and the velvety aspect is striking. The culture arises several millimeters from the surface of the medium and grows thick and resistant. The folds are high, broad and numerous. To a high fold succeeds a profound depression. Intermediate folds and a border are wanting. This is a good medium for the artificial culture of the *O. brasiliense.*

Glycerine—gelatine.

It is liquefied within 30 days. A thick, yellowish pellicle on the surface.

Simple broth.

Formation of flakes. A thick, dark-gray pellicle rapidly forms. After several months there is a brownish-white deposit and a clear liquid over it. No clouding is oberved. This medium contains many yeast cells and mycelium forms of the fungus.

Glycerine broth.

In our studies we preferred this medium for obtaining large quantities of the fungus. Balloons of 3 to 4 liters, sown with *O. brasiliense*, show, after 6 or 8 days, the beginning formation of the dark-brown pellicle. Once formed, it spreads rapidly all over the surface of the fluid. Little by little it attains the thickness of several millimeters and becomes tomentous. After 15 or 20 days more or less dense flakes begin to sink from the lower face of the large floating pellicle to the interior of the liquid until, after 70 to 90 days, the liquid becomes perfectly clear, while a viscous network, abont 0,5 cm. high, is formed on the bottom of the balloon.

The very same aspect of the culture is repeated whenever we use this medium for sowing the parasite.

Medium for conservation.

Poor cultures, even when showing the aspect of the cultures in *Sabouraud with maltose.*

Sabouraud with raw sugar.

Abundant cultures. From the beginning they look like the cultures of *Sabouraud with maltose,* however without their characteristical development.

	Fermentation	Pellicle	Gases
Saccharose	Yes	Yes	No
Galactose	«	No	«
Nutrose	«	Yes	«
Milk	«	«	«
Mannite	«	No	«
Levulose	«	«	«
Bassiekow I	«	«	«
Bassiekow II	«	«	various
Bread	«	(dense, flocculent)	No
Raffinose	«	Yes	«
Dextrine	«	«	«

Glycose broth.

Culture abundant, appearing soon. Various forms of the parasite. Pellicle thick, brownish-white. Deposit abundant. Good medium for the study of the fungus in hanging-drop culture.

Media containing blood.

(Sabouraud, broth, agar-agar, etc.)

The culture of the parasite is not greatly modified by adding blood, and, in our opinion, these media offer no advantage.

Drigalski—Conradi.

The parasite develops very well in this medium. Same aspect as in *Sabouraud* with maltose, except, perhaps, for the colour, which here is violet.

The thick, high and crinkled culture, contrasting with the medium, is thoroughly stained, not only by reflexion of the medium. (This phenomenon was seen before in other brasilian *mycoses).* It is a good medium for the diagnosis of the parasite in suspect sputa and we may say the same of the medium of ENDO, though with some restriction, because the finer constitution is liable to alteration. The cultures here become reddish ; they are thick, velvety, abundant and rapidly formed.

Poor medium.

This medium is suited to the study of the sporulation of the fungus; it was proposed by Mlle. GORODKOWA (1908) to substitute that of ENGEL-HANSEN.

It is more simple than the latter and does not need crystalizers, HANSEN's vials or other implements, not used in the common cultures of fungi. Germination begins soon. The medium being rapidly exhausted, the development of the parasite becomes remarkably slow. The medium has the ordinary aspect of the *Sabouraud* with maltose and may be used for the study of the biology of the fungus.

LOEFFLER's Medium.

Development is easily obtained. Cultures crinkled and velvety. The medium is important for comparative study of the morphology.

(The forms of the fungus are similar to those of the sputum).

Alkaline Sabouraud.

The *O. brasiliense* develops abundantly and quickly in intensively alkaline *Sabouraud* with maltose. The cultures are thick, velvety, and similar to those on the classical *Sabouraud* with maltose. The medium is useful for differential diagnosis.

Exactly the contrary happens in *acidified Sabouraud.* Here the parasite develops with difficulty or not at all. The media made with various vegetables are favourable for the development of the fungus.

We tried the *O. brasiliense* in cultures by the classical methode for the *Sporotricha*, i. e. cultures on slides (BEURMANN & GOUGEROT). It did not develop well in them. In hanging drop preparations the growth stops, when the medium becomes dry.

Microscopical examination of the artificial cultures.

The microscopical examination of the *O. brasiliense* is very instructive. The first difficulty is to obtain a regular process of fixation and staining, for few processes give a good and clear view of the parasite.

The fixation, which gave us the best result for simple smears, was made with SCHAUDINN's sublimate-alcohol, either hot or cold (wet smears). The fixation by absolute alcohol can be applied to wet and dry smears.

The cells and the mycelia of the parasite, fixed by these two processes, are as well conserved, as one might wish for. The morphology is equal to that found in hanging drop. We also experimented, though with inferior results, osmic acid, methyl alcohol, heat etc. The stains of the smears may vary a good deal. The best stain for the cy-

tology is, in our opinion, that of GIEMSA or UNNA with differentiation. We obtained typical preparations with both stains. The hematoxylin also may give important details. SAHLI's blue is splendid for perfunctory examination of sputum. In order to obtain more details by this stain, it is necessary to differenciate the preparations after colouring. We used absolute alcohol or alcohol-acetone (1/3). This process does not depend on a special fixation. With any of them the result is very good. UNNA's blue (formula of BESSON) and LEISHMAN's stain give good structural details of the fungus. Thionin, the triacid of EHRLICH, methyleneblue, ZIEHLS fuchsin, eosin, Sudan III, "Neutralroth", VAN GIESON and tincture of iodine were used, with varying results, for the systematical study of the morphology and the microchemistry of the fungus.

Artificial cultures.

In the begining of germination the yeast forms prevail. They are elliptical, oval, polygonal (center of the culture), rarely spherical. These forms show, as a rule, two different aspects: a) attached to each other; or b) free in the microscope field. The former are abundant in the medium of GORODKOWA or in the old cultures of *Sabouraud* with maltose. We see here spherical yeasts with double outline and an involving, slightly rosecoloured border. Protoplasm uniformly stained blue. In most cases, however, these forms show only the double outline of the membrane stained. The protoplasm does not stain. They are apparently empty cells. The size of the forms varies from 5 to 6 *micra*. When deformed, they may show the appearence of a mosaic.

These different aspects of the parasite are of much interest for the identification of some tissue forms. They recall, by perfect ressemblance, the forms of the "*Oidium brasiliense*" in the lungs of man and monkey. We understand, therefore, easily, how from them may derive the yeast forms, surrounded by a border and found in the human sputum. We must not confound such forms (especially those with the staining limited to the membrane) with the involving viscous net of certain yeasts. In the former appears the cell itself, in the latter the skeleton. Where as the net is not or badly stained, cells with protoplasm having strong affinity for colours stain blue or pale violet. From these rectangular forms derive the rectangular pseudo-mycelian forms, seen in the culture of *O. brasiliense* and in the foci of human pulmonary lesions.

The free forms have, as a rule, the classical aspect of yeasts. They appear in several shapes, elliptical, elongated or oval and measure about 3 *micra*, but sometimes up to 6 or more. In the old cultures on *Sabouraud* with maltose or in the water of carrot cultures they may even attain 8 *micra*. In fresh cultures, made on LOEFFLER's medium, they recall the forms found in the sputa. Gemmation is the rule. We also observed the so-called "transversal septation". It is a gemmation, where there is a stainable septum between the gem and the mother-cell. In the classical gemmation sometimes a division of the chromatin is seen. First it becomes elongate; in some figures we see a long thread uniting the chromatin of the mother-cell with that of the daughter cell through a cellular constriction. The thread is finally severed, the constriction becomes complete and both the new cells show a chromatin granule.

We call attention to this aspect of yeast cells with or without septa. It represents a serious objection to certain systematical subdivisions. Here the distribution of the chromatin is typical. At first undivided and thick in the center of the yeast, it is fragmented through the multiplication of the cells. Agglomerated subsequently in the zone of constriction, it is divided in different portions for the gem and the mother cell and condensed again in the center of the newly formed cell. It must be known that these facts are observed in divisions with or without septa. However, when a

septum exists before the definitive separation of the new cells, it lies in the region of constriction. The disappearing of the septum coincides, as a rule, with the condensation of the chromatin in the center of the new cell.

Besides these facts, we find other ones of some interest, as regards the reproduction. The gemmation is the general form of cellular division in the yeasts. This process, a variety of "septation", occupies an intermediate place between the typical gemmation and the true septation of the *Schizosaccharomyces* which, according to some mycologists, constitutes a definite group, having as type the *Sacch. ludwigii*. In the *O. brasiliense* the gemmation is, in certain conditions, found in human and animal organisms and in the center of some cultures. The second process, the variety "transversal septation", is found, almost exclusively, in some cultures of the parasite and in certain foci in human lungs (preparation made after 87 days of culture in *Sabouraud*). It is often easy to discover one of the characteristicals of the *Oidia* at the extremity of a mycelium. 6 or 7 yeast cells are following on a mycelian element. There are forms, though rare, which we must consider as terminal *chlamidospores*. They are large spherical yeast cell with double outline, clear and deeply stained protoplasm and terminating unexpectedly a short or long mycelium. There are also intercalary chlamidospores. If the preparations turn out well, the yeast cells, when in rest, show a complicate structure (preparation after 87 days of culture).

A figure of such forms accompanies this paper. It represents a detached cell with fragments of the viscous border still at the periphery. The protoplasm is of pale, and the nucleus of deep rose-colour. Intensily stained and brilliant granules, seen close by, are metachromatic granulations. There are no vacuoles. The cellular membrane is fine and deep red. Sometimes the structure is more complicate. There is an elongated cell with thick cellular membrane, excentric voluminous nucleus and broad nuclear membrane. Within the nucleus we see a more deeply stained granule and by its side metachromatic granulations. Here also we find no vacuoles. When such appear in these forms they are, in our opinion, due to a faulty technique.

Mycelium.

The mycelium of the *Oidium brasiliense* shows various aspects. The mycelian structure is abundant in potatoe — and in carrot-cultures, but not all cultures of the parasites show such abundance. As a rule, at first the mycelia do not exist in the cultures of the fungus. To the breadth of 3 *micra* we may add one of 6 *micra*, observed in old culture forms on *Sabouraud*, with great variety of granulations and showing, sometimes, a complete endoconidium. The slender forms are found indifferently in the cultures. The mycelium is wavy.

In the water of carrot-culturetubes we may possibly see fine and long mycelia (running through many microscope fields), irregularly divided and, at intervals, septate (Photograph taken with obj. C, ocul. 4 of ZEISS). The endoconidia are here found in greater proportion. We accompanied the mycelium formation, examining the stained and hanging-drop preparations.

There are, in our opinion, two processes of mycelium formation. Sometimes from a rectangular element with large nucleus and deeply stained protoplasm springs another, also rectangular, though more elongate. The new cells stretch successively until a true mycelium appears. At other times a large cell, either spherical or oval, gives growth to smaller cells and forms, after some divisions, a true mycelium. In this case, as a second variety, the mycelium may not show any gemformation and spring directly from the round cell. Here a thickening of the cellular membrane is often seen at the point of emerging of the mycelium. The distribution of the chromatin in the mycelium does not, as a rule, follow well defined types. Sometimes the mycelium presents in all the septa

a small quantity of chromatin in the center of the protoplasma; at other times the chromatin, if present, is subdivided or diffuse.

In old cultures the mycelium is pale and uniformly stained. When the mycelium is fine and without septa, we frequently see, at intervals, small masses of chromatin belonging to the cell, from which springs the mycelium. These forms, found in cultures, remove serious doubts about similar forms, found in smears of organs in post-mortem examination. Nor would it be the first time that a mycelium was confounded with the filamentous form of certain bacilli (see BONCHI, JUNGANO, etc.). This cause of error in autopsies is not to be forgotten. The examination of these fine mycelia in different preparations leads to an exact notion of the importance of the small masses of chromatin described above. They give birth to important elements of the fungus. The protoplasm around this chromatin tends to condense itself and is more deeply stained than in other parts of the mycelium. Shortly afterwards appears the first sign of a membrane, which rapidly acquires a distinct outline. The endoconidia are formed. After the mycelium is broken or divided (which is the rule), the new phase of the cycle of the fungus begins. The division of the mycelium varies. The cylindrical or rectangular forms do not obey to a regular systematical division. From dichotomisations and trichotomisations to the most unexpected divisions may be found.

The terminations of the mycelium are neither constricted, nore more voluminous. The articulations of the mycelian elements also are not imbricated and might be considered articulations by simple contact. The endoconidia are oval or rectangular. The septa of the mycelium disappear in old cultures. The best and most common aspect is that which resembles rectangular elements, united at the ends where the mycelium is very brittle.

Strange forms.

These forms are morphological aspects of the parasite, apt to lead the observer astray. Careful attention helps a good deal to understand them. In the cultures of poor media as, for instance, the exsudation of serous membranes, one finds sometimes mostly coccuslike forms with double outline, producing gems or not. There are forms which recall those of the *Adenomyces* of the human lymphglands. These are special forms of bacillary type in which various granulations are seen. We give some photographs of them.

There are, furthermore, forms "en navette".

We also find bacilli with an irregular dilatation at one of the extremities, in which an intensely stained granulation is seen. The bacillus is septated a little above the dilatation. This polymorphism is not at all strange, as we know, that it is no exception amongst the infinitely small beings. Amongst many others the MUCH-MELLER's microbe is an eloquent example of this, and, were it not for the pure origin of the culture, one might declare it a whole scale of various microbes.

The hanging-drop cultures are well suited to the study of the biology of the *Oidium brasiliense.* We always preferred the glucosebroth or GORODKOWA's medium. The aspect of the fungus observed in this way, is the same, as in stained preparations.

In animals.—Experiments.

Experimental disease.

This is one of the most interesting chapters of the biology of the fungus. White and gray rats, mice, guinea-pigs, rabbits and monkeys (*Hapale penicillata, Callithrix iacchus,* and *Alouata fusca)* always die, when inoculated *by any way* with culture emulsion of *Oidium brasiliense.*

We obtained positive results by the following ways:

a) intermuscular

b) intravenous

c) subcutaneous
d) intraperitoneal
e) tracheal
f) buccal
g) nasal
h) bucco-nasal
i) pharyngeal

The age of the culture may affect the pathogenic power of the parasite. Cultures on Sabouraud with maltose, dating from more than a year, proved virulent for laboratory animals. We noted, however, that the virulence of the parasite gradually diminishes with age. The pathogenic power of a fresh culture (of two months) is not the same, but rather stronger than that of a two years culture. Simple painting of the buccal mucosa (without *scarification*) with culture-emulsion in physiological salt solution kills the animal by the experimental disease. This power of penetration of the *Oidium brasiliense* is highly interesting and explains clearly, how the human disease is caused. The five monkeys (4 *Hapale penicillata* and 1 *Alouata fusca),* inoculated in this way, all died with typical lesions, though after varying periods. The intermuscular way also is exceedingly important, as it led us to the well founded conviction that the *Oidium brasiliense* has a predilection for the lungs.

The tendency of the parasite to pulmonary localisation is a fact. Some animals, infected by intramuscular way, died with lesions limited to the lungs, and only from these could we recover the parasite. The smears, cultures, etc. of the points of inoculations never gave the *Oidium brasiliense.* This fact is the more interesting, as we know that the lung localisation of the fungus is the chief manifestation of the human disease. After a long time of study we find it dificult to state, which of the laboratory animals is the most sensitive for the *Oidium brasiliense.*

We prefer the *saguin* (*Callithrix iacchus*, to any other animal. Injected with 0,5 ccm. of emulsion of the fungus by intraperitoneal way (fresh culture of two months of age) the saguins may die *within 22 hours* from septicemia. With cultures of 2 years, death insues later, sometimes only after several months. In either case the experimental disease is chiefly characterized by its attacks on the serous membranes, the lymphatic glands and the lungs; the inflammation ot the former is a rule, almost without exception, in the experimental disease.

Even in the forms of rapid septicemia (22 hours) the serosae are not spared. These lesions of the serosae in the beginning of the experimental infection corroborates the suspicions gathered from observation on patients, that the first phenomenon of the disease is a serositis.

Another important fact, shown by the experimental disease of the saguin, was the explication of some lesions of lymph glands. In post-mortem examinations, performed in fatal infections with *Oidium brasiliense,* the tumefaction of the mesenteric glands sometimes called our attention. We succeeded in reproducing this glandular swelling in the saguin. We give a photograph of the mesentery of one of these animals, infected by the peritoneum with a three years culture of *Oidium brasiliense.* It shows, how the swelling of the mesenteric glands in man may find its explication by the point of penetration of the germ (intestine, peritoneum). From these glands and from the liquid of the serosae new cultures of the fungus were directly isolated.

In the septicemic forms we obtained in the first attempt pure cultures of the parasite from *all the organs* of the saguin. In the chronic form we find, as rule, remarkable congestion of the lungs and varying degeneration of the organs. In septicemia there are microscopical abscesses, chiefly in the lungs, kidneys and spleen, besides various degenerations of other viscera.

The infected *Callithrix* does not show anything remarkable in its clinical aspect, while it is not so in the case of *Hapale* and *Alouata.*

The clinical aspect of the experimental disease in the latter monkeys is of great

importance. Shortly after the painting of the bucco-nasal mucosa (without scarification) the experimental disease begins with progressive emaciation of the animal. Cough follows and the monkey takes little food. The *facies* is emaciated and tbe expression is torpid. The animal becomes indolent. Little by little, the wheazing first noted gives way to subdued groaning. The animal lies in a heap at the farer end of the cage. The anorexia is next to absolute. The coughing fits become frequent and endless. Cachexia sets in. After one or two months the animal succumbs in a state of extreme emaciation. So died the 5 monkeys of the two latter species, injected with the *Oidium brasiliense*. The lungs were teaming withe the fungus.

The *white rat* also is well suited for these researches. The time of evolution of the disease varies. It presents nearly always a *polyorrhomenitis*. In the serous fluid there are characteristical forms, similar to those of cultures grown on media either poor or exhausted in course of time (abnormal forms). They are equal to those seen in GORODKOWA's medium and are anomalous elements. A large spherical cell with double outline and homogeneous protoplasm gives birth to very small gemmules. There are indications of mycelia, only 0,5 *micra* wide and 1 or 2 *micra* long, also yeasts like the elliptic, pasteurian and spherical forms, frequently very numerous. The protoplasm of the smallest yeasts stains badly. Such forms of the fungus are seen in any exsudate, while its duration is indicated by their abundance. It is of importance to know that in liquids of long standing and in residues of old effusions, there are, besides the described forms, mycelia of varying aspect. In the effusions of human serosae we also observe a strange aspect of the parasite. This similarity of the forms from the serous membranes and those from poor media deserves consideration, as indicating that the serosae are not a good medium for the growth of *Oidium brasiliense*. KLECKI observed already that the virulence of some bacilli, obtained from the peritoneal cavity, is weakened. DIEULAFOY bases upon such facts, although with some reserve, the explication of what he calls "deceiving calm" in the chapter referring to appendicitis. The *Oidium brasiliense*, virulent in the circulation and in the organs, is to some extent weakened in the serous membranes of certain animals. The pleural stage of the human infection, primitive in our opinion, is a calm, if not unperceived stage. The white rat is suited for inoculation of the sputum. The lungs are always affected.

We obtain a second passage by injecting recovered cultures and triturations of the lung. There are cases of intense swelling of the tracheobronchial glands. The spleen and the liver are, as a rule, swollen.

The *rabbit* is very susceptible to infection with *Oidium brasiliense*. The experimental disease in this animal shows two forms: the *acute* and the *chronic*. We succeeded in accompanying the evolution of the disease in a rabbit for 1 year and 80 days, while in an other case, death ensued within 5 days.

The intravenous infection produces in this animal a septicemia with microscopical abscesses scattered all over the organism. The polyserositis is not so common here, as in the rat and the monkey. The spleen is sometimes enormous. The suprarenal capsules are almost always increased in size. The lungs show from smallest congested zones to inflammations of basis, apex and whole lungs or cavernae (Note 1). In the long lasting case just mentioned the lung of the rabbit was reduced to strings of connective tissue, joining the two inner sides of the thoracic walls. The tracheobronchial glands sometimes reach the size of a mediastinal tumour. This tumefaction is the rule in the infection by the trachea andt he bucco-nasal mucous membrane and ressembles the enormous tracheo-bronchial adenopathies found in people who died from infection with *O. brasiliense*. Here, as in the mesentery, the point of penetration of the para-

1) The tendency of chronic lesions in man is hepatisation and cavern formation.

site explains the localisation of lymphatic lesions. The fungus, on penetrating either by the intestine or by the trachea and the bronchi, finds in the mesenteric or tracheobronchial glands the first bar to its invasion of the organism. Intraperitoneal inoculation of cultures, killed by heat, are fatal to rabbits, especially when large doses are used. For living cultures any way of infection gives very good results in the rabbit. This pathogenic power is sometimes of great value for differential diagnosis. The tendency of the parasite to pulmonary localisation is remarkable in the rabbit. We always succeed in finding the fungus in the lungs, when it is impossible to detect it in any other organ. The intramuscular inoculation often causes lesions limited to the lungs.

Mice also are susceptible to infections with *Oidium brasiliense.* Inoculation at the root of the tail or by the peritoneum quickly kills the animal. Sometimes we observe effusion in the serous cavities, mostly in one of them. The spleen may attain large proportions. In the second passage death insues quicker.

The *guinea-pig* is less susceptible than the above cited animals, but is useful for diferential diagnosis with tuberculosis, caused by KOCH's bacillus. The evolution of the experimental infection may vary from 4 days to 6 months. We often met with general serous effusions. Spleen and liver are almost always increased in size. The suprarenal capsules are swollen, and the kidneys are affected by various forms of degeneration. Polyadenitis is the rule. The mediastinal and the higher tracheo-bronchial glands rarely escape, principally after infection by the tracheal and bucco-nasal mucosa, and often attain a large size. The subcutaneous inoculations of the abdominal wall leads to lateral lymphadenitis of the abdomen, and this form of adenitis must be remembered, as it is the rule in the tuberculous guinea-pig (KOCH's bacillus). In the infection with *Oidium brasiliense*, smears, triturations, inoculations etc., made from such ganglions, never demonstrate KOCH's bacillus. We tried to find this bacillus by all means actually known. These researches were repeated not only for the ganglions, but also for all the organs of any infected animal found dead.

Lungs of guinea-pigs, killed by *Oidium brasiliense*, are congested. We never found miliary abscesses, except in septicemic forms. The evolution after inoculations with suspect sputum is variable. If the flora of common microbes is poor, the area of inoculation, slightly swollen and red in the first days, returns soon to normal conditions, without any trace remaining. In sputa with abundant flora abscesses are formed. If the animals resist, cicatrisation follows quickly. The torpid ulcer of tuberculosis, due to KOCH's bacillus, which heals with difficulty or not at all, is never seen. In the guinea-pig too we observe the tendency of the parasite to pulmonary localisation. Intramuscular inoculation sometimes produced an infection limited to the lungs.

Resuming, we see that in all the inoculations of animals we obtained encouraging results, the more as we completed PASTEUR's cycle by recovering the parasite from animals, killed by the experimental disease. What we especially want to insist upon, is the reproduction in animals of the symptoms and all the anatomical lesions, observed in patients of the spontaneous disease.

The research of *Oidium brasiliense* in smears of the organs of the animals is relatively easy. Preparations mostly team with fungus elements. The morphology here is various. The yeast-forms prevail in smears of the organs, though mixed forms are common. Filtration in BERKEFELD filter sterilises the cultures of the *Oidium brasiliense.* Filtered cultures do not grow nor infect. Heating to 56° for 1 hour kills the fungus. Cultures, sterilised in this way, are harmless, when injected subcutaneously. While hyper-immunizing rabbits for serological purposes we arrived at 4 injections of 20 ccm. with intervals of 4 days, the animal only showing slight emaciation. The same

does not succeed with animals, inoculated by the peritoneum. Death here is the rule. The post-mortem examination reveals, besides great emaciation, a diffuse serous peritonitis.

In man.

Clinical aspect.

The human oidiomycosis shows a group of symptoms identical with that of tuberculosis caused by KOCH's bacillus. Now that differential diagnosis is possible, we may say that the disease is a tuberculosis without KOCH's bacillus and with *Oidium brasiliense.* Many cases of oidiomycosis, in want of another name, have undoubtedly been hidden under the label tuberculosis or syphilis.

As a rule, the general condition of the patient is bad. Even in the first periods, the *facies* is pale, dejected, emaciated. The mucosae have a sallow aspect, due to the poverty in red blood corpuscles and hemoglobin and rarely missed in the clinical picture. At the beginning anorexia is rare. We saw fatal cases, where bulimia succeeded to absolute anorexia. Remissions are transitory. Fatal relapse succeeds almost always to the glimmering hope of salvation.

Improvements are casual (as seen in many human mycoses) and their cause is not explained exactly by either clinical observation or microscopy. The physical power of the individual sinks remarkably. In the last periods of the disease, the emaciation of the patient is extreme. We do not know of any other disease surpassing it in this respect. From the begining the patients generally have a fetid and nauseous breath. This bad smell has nothing characteristical; however, it is distinguished from that of pulmonary or bronchial gangrene (type PIRQUET). The group of symptoms also separates the Oidiomycosis from the curable fetid bronchitis (LASÉGUE). The latter is, in preference, the disease of week convalescents, whose organic resistance has suffered from some debilitating and fatal influence. This fetidness disappears, when the patient is recovering from oidiosis. For clinical orientation we admit two principal periods in the disease:

1°—*the period of incubation.*

2°—*the period of manifest disease.*

This includes acute and chronic forms, the latter wich 3 periods according to the evolutionary stages of the parasite in the lung. Here we shall study also the *inflammation of serosae* and finally the *oidiomycotic cachexia.*

The first period represents a silent strugle. The parasite penetrates into the organism through the affected or healthy tonsils or mucosae (in monkeys *Alouatta* we obtained penetration of the parasite through the bucco-nasal mucosa). If the defense of the epithelia fails, the fungus establishes itself by preference in the lymphatic system for a new attack. From our patients we did not gather much information about this mucoso-amygdalo-ganglionic period. They are, as a rule, ineducated and do not inform anything of value for the history of the disease; what we know and found out about this period of the disease is due exclusively to post-mortem examinations and to experiments. Only to the results of those do we owe the understanding of this period of the disease; then and only then could we obtain a lasting result by accompanying carefully the clinical syndromes. This initial period of the disease is one of silent struggle, where, as a rule, it is not recognized. The adenitis of the neck, the tracheo-bronchial glands and those of the mesentery are mute and painless lesions of the lymph nodules. The hypertrophy which here may attain extreme dimensions, prejudicial to the neighbouring organs and even to the life of the patient (compression of the pneumogastric nerves, the trachea, etc.), has not, however, the ostentatious aspect of the violent inflammatory and transitory forms. In oidiomycosis there exists only hypertrophy varying in size and aspect.

This stage, if not passing entirely unperceived, is rarely remembred by the patient giving the history of the disease. By percussion the practitioner obtains some information, helped by careful examination of the

patient. The x-rays, however, are decisive (Radiograph N. 1. Tracheo-bronchial adenopathy caused by *Oidium brasiliense).* However, we did not find the abundant symptomatology, attributed by some authors to the tracheo-bronchial adenopathies. Even when, as in patient 506 (ward of Dr. SAMUEL LIBANIO), the lymphadenitis was remarkable during life-time, it little helped the diagnosis. There was no thoracic deformation, nor circulation of the higher prethoracic or the middle thoracic (CARRY) or intermediary type, nor signs of FERNET, etc., shortly, none of the signs indicated as expression of these adenopathies. They must be carefully searched for by watching attentively the subjective signs, revealed by the patient. Once diagnosed, the process must be distinguished from similar affections. Here the clinical observation is not sufficient; we must study the particular and specific biological reactions, giving more reliable indication for diagnosis. In this way we discard the neoplasms of the lymph glands, which principally produce a striking symptomatology, the hypertrophy of the thymus (children) with almost exclusively respiratory symptoms, the hooping-cough with similar coughing, though with more marked inspirations, mucosities and different evolution, and, specially, syphilitic, mycotic, tuberculous and various post-infectious forms of adenopathy and mediastinitis. The latter group is of the highest importance on account of the manyfold clinical aspects, possibly present.

Here we have COMBY's chronic mediastinitis, which imitates the tracheo-bronchial adenopathies, denouncing itself, however, by the participation of the pericardium (with a series of consequences of increasing gravity) or a syphilitic adenopathy, not common, slow, insidious, due to intense generalised infection or pulmonary lesion, or a tubercular gland lesion, also slow and insidious, not rarely multiple and forming by fusion large tracheo-bronchial masses; there are, moreover, various and complicated mycotic adenites, of which the sporotrichotic adenitis is a perfect type. This is the reason why we resort to the immunity reactions. The suspected patient, after the clinical examination, was submitted to cuti-reaction, to ophthalmo-reaction (KOCH) WASSERMANN's reaction (classic), to direct researches on the glands of annexed systems (neck) and principally to intradermal reaction and to the specific fixation test of *Oidium brasiliense.*

The two latter reactions, though still in the period of comparative researches, gave us already some information on this difficult chapter of the disease (vide *Diagnosis*).

As a last recourse remains, for many cases, the treatment with iodides. The amygdalitis has been confounded with many other kinds. We isolated pure cultures of the fungus from many cases. The local treatment (iodine water) cures rapidly. These lesions are of some importance for the etiology of the disease.

After overcoming the barrier of the lymph glands and passing through the mucosa of the tonsils, the fungus invades the organism through the circulation. This is the beginning of the "manifest disease".

Inflammation of serous membranes.

The lesion of the serosae must begin on this occasion. Experiments, assisting clinical observation, fully prove this point. The serosae (sometimes all of them) resent the attack of the germ already a few hours after the inoculation of the fungus.

It has not yet been possible to detect the beginning of this serositis. Perhaps continual observation of this point may give us soon the decisive proof. However, we can already state, that, until now, no case of the disease with integrity of the serosas has been observed in man, even when, as in some of our patients, the clinical examination finds little or nothing at all during life-time. The post-mortem shows residues of old lesions. The very age of these lesions explains the absence of any constant clinical sign indicating serositis.

We all know, how difficult it sometimes is, to establish the clinical diagnosis of the residues of old effusions; of course, we do not refer to the large residues, to extensive adherences and symphysis, but to small and minute, almost vanished rests.

The patients rarely came in our observation during the first period of the "manifest disease". They mostly arrived in an advanced stage of the disease.

In the last period of the disease there are cases with immense effusion, which may attain one or all the serosae. The experimentation reproduces this fact. The inoculated animal shows only effusion in one serosa, or may present *polyorrhomenitis*. The parasite is observed in the fluid of effusion in man and animal. These forms, attacking the serosae, are discussed in another part. The most interesting point in this question of effusion is that the experimentation reproduces in animals all varieties of effusions in man.

All of them, sanguinolent, serous, fibrinous, serofibrinous, etc. were reobtained in monkeys, rabbits, rats or guinea-pigs. We went further and succeeded in obtaining in chronic forms, residues of such effusions alike to those of the human cases. The spots, the thickening, the adherences, etc. are remainders, which may be observed in animals. To the silent or almost indiscernible struggle of the anterior period succeeds a stage with, more or less, abundant clinical symptoms. The human pericarditis, caused by the *Oidium*, has various forms. We observe the most varied aspect, from small attacks to large collections of fluid with absolute and extensive dullness on percussion, abolishing of murmurs, disappearing of the shock and deviation of the apex of the heart, protrusion of the precordial region, with variations of TRAUBE'S space, according to the position of the patient etc., and even the sequel of dyspnoea, angina pectoris, arrhythmia of the pulse and fall of the blood pressure is not missing.

The pleuresy may be uni- or bilateral. Cases, in which there is no liquid, which sometimes may exist in truly remarkable quantity (our first observation, followed by post-mortem examination) are rare. The examination of such patients is today indicated by clinical rules for the diagnosis of collections of fluid in the pleural cavities.

The inspection, palpation, percussion, auscultation and dislocation of some organs in patients suffering from pleural effusions, caused by the *Oidium brasiliense*, reveal many varieties, from small deviation of the xiphoid process to almost complete disappearing of the respiratory movements and considerable development of a hemithorax; from diminishing to abolition of vocal vibrations, not to forget deviations of heart and liver and accentuation of those vibrations above the region of the effusion. The percussion furnishes, undoubtedly, precious informations at the level of or above the effusion. In the first case we find variations from the absolute dullness, passing through the diminished resonance, from the not-tympanic infraclavicular resonance to the absolute dullness of the same region, also, in the case of large effusions, intercostal fluctuation and in those of 1/3 or 1/2 of the pleural cavity Skoda's sound. To the variations in the lines of dullness (of which DAMOISEAU's curve is the prevailing figure), including those of the triangles of GARLAND and AUTRIC, the above cited signs of percussion are added.

There are, furthermore, signs of auscultation: diminishing or disappearing of the vesicular murmur and the vocal repercussion, soft bronchial breathing, with or without egophony, etc. and even absolute silence with complete abolition of the vocal repercussion.

We cite, also, coughing, dyspnoea, fever, tachycardia (with weak pulse), oliguria, sometimes albuminuria, etc. The fluid of the pleural effusion shows various characters; the fibrinous aspect, however, always prevails. Sometimes it contains blood. In animal experiments the same alternatives are observed. Cytological research reveals a leucocytosis, which has not yet been wholly studied and defined. The examinations of these fluids are negative, as regards KOCH's bacillus.

The fungus-forms are always present and the fresher the pleural effusion, the greater is the number of parasites.

The examination of the abdomen in the 2d and chiefly, in the 3rd period of the chronic form of the human disease reveals nearly always the presence of ascites. The peritoneal affection proceeds, without much show, from small effusions to those of large quantities. Here also we find the fungus. In the experimental disease the peritoneum is one of the best places for obtaining culture material. The inspection, the palpation and the percussion, all together, furnish elements for the diagnosis. The palpation reveals the senation of waves, of great value for the diagnosis of the effusion. We sea, furthermore, general symptoms due to effusion, as compression of the abdominal vessels (vena cava inferior) and subsequent edema of the limbs. Neither in the experimental disease, nor in the human did we find a localised effusion. The nature of the abdominal effusion is various; not rarely it is hemorrhagical. The effusion in the serosae, either isolated or multiple, are constant, especially at the second period of the manifest disease and afterwards.

Acute form.

In the begining of 1916 a patient, suspected of pulmonary mycosis was received in the ward of Prof. SAMUEL LIBANIO.

The microbiological researches, made by us, showed that it was another case of this disease.

Various occupations forced us to leave Bello Horizonte for a rather long time.

The study of the morbid symptoms was completed by Prof. SAMUEL LIBANIO.

The patient, a young man, presented a symptomatology rather different from the ordinary type of the disease, we were accompanying.

The fatal evolution of the human disease within a little more than thirty days, fully justified the designation "acute form" and so it was already considered by Prof. SAMUEL LIBANIO at the last Congress of Medicine in Buenos Aires.

In five years work we collected several dozens of cases of this "pulmonary oidiosis", some with sufficient details, others with as many as allowed by circumstances.

Only three of those showed the unexpected symptoms, which constitute the *substratum* of the "acute form" of the human disease, which, in fact, is excepcional.

The first case was seen in 1913 in the ward of Dr. E. LOUREIRO; the second in 1916 in the ward of Prof. SAMUEL LIBANIO, the third this year, in the private practice of Dr. MARCELLO LIBANIO.

The obtaining of these clinical observations in the hospital was a rare coincidence.

The social conditions of the interior of Brazil rarely allow the begining of a disease to coincide with the entry of the patient in the hospital.

The "sertanejo" only takes refuge to charity, overcoming the superstition, which deters him, when the disease is already in full evolution, serious and deep-rooted. Nor is there an anamnesis worth mentioning, as it is almost always wholly valueless, deficient or even absurd.

The expression "acute" is used only for clinical classification. It is due to the same parasite, which finds a favourable field in a sensitive organism. Hence the violence of the disease.

Time will show that the transformation of acute form into a chronic process, is not at all impossible and that the acute exacerbation from the marasmus of a chronic form is not absurd.

Our patient (M. N. 1) fully proved that at least the latter hypothesis is possible. She entered the Maternity of Bello-Horizonte showing a chronical form of the disease and on 4—12—16 left spontaneously "in tolerable condition", consideraby improved by the treatment with iodides, but not cured. She

1) For this observation we are indebted to Prof. HUGO WERNECK.

came back, some time later, in a very serious condition and died in the ward of Prof. BALENA, on the 22–12–16.

The cases of pulmonary oidiosis, either acute or chronic, are always fatal, if not treated.

In acute or chronic cases one or more serous cavities are always attacked.

In acute or chronic cases congestive processes prevail.

In acute or chronic cases immunoreactions are the same.

In acute or chronic cases treatment is the same.

The general conditions of the patient of the acute form are, in the begining, without important characteristics. They are generally confounded with the initial stage of the infectious diseases, showing the same prostration, the same accentuated general depression, the same disturbing sudden indisposition, caused by the attack of microbes. In the begining fever rises to the highest curve but, shortly afterwards, it assumes a very irregular form of rising and falling. The difference shown by the two processes (i. e. the chronic and the acute forms) in their irregular curves of fever is the height of the thermographical elevation. While in the acute cases fever rises, though irregularly, to 39 and 40°, in the chronic forms it hardly attains, though also irregular, 38° in the armpit.

In the acute forms fever may fall, within 24 hours, from 39 to 36°, rising in the next days to 39°.

In the chronic cases the curve goes up and down between 35 and 36°, with an average of 37° and some tenths.

Under treatment the temperature does not fall immediately, but the decided effect of the medicine is followed by a gradual diminution of the fever. This lysis is verified in the acute as well, as in the chronic form. In the acute form the pulse is, as a rule, full and ample, the pulsations being between 100 a 140. Except for this correlative tachycardia, there are no perceptible disturbances of the cardiac rhythm; what here calls our attention, is the respiratory system.

In one of the 3 clinical observations, we made, the lesions of this system looked like those of a true pleuropneumonia of the right lobe 1). Here we find the pain in the hemithorax, high fever, intense prostration, dyspnoea, chills, dullness, stertores with crepitation, tubal breathing, pleural attrition etc. What we fail to find, is the well known evolution of this pulmonary disease. The sputa are hemoptoic.

After some 30 days we begin to note perceptible alterations in the condition of the lung, which till then remained constant and unalterated. There is now an accentuation of the signs of liquid collection, variable according to the case. They vary from a third to almost the totality of the two hemithoraces, though effusion is not constant. In one or in both lungs we perceive signs of softening of the parenchyma. The apices, as a rule, initiate the process. Outside of these regions, the lung or the lungs appear as a compact and massive block.

Abundant extensive stertores are scattered, in various foci, all over the lesion. Not rarely and especially at the bases do we find regions, where only dullness of respiration is perceived. Pseudo-cavitary breathing is observed in circumscribed regions of the organ.

The temperature, rising and falling irregularly, continues high, reaching 39 and 40° in the sudden risings; often it is only in this period of pulmonary affection, that the patient goes to the hospital. Hence the difficulty of the diagnosis. The sputa are abundant and the hemoptysis may persist.

By some of the symptoms one is reminded of "caseous pneumonia", by others of GAUCHER's form.

The general condition becomes worse; paleness is remarkable and emaciation extreme. The bones seem to swell beneath the retrac-

1) For the first part of an observation, which justies some details of this description, we are, partly indebted to Dr. ABEL TAVARES DE LACERDA (Military Hospital) With Dr. MARCELLIO LIBANIO, we obtained the second part in the house of the patient.

ted and burning skin. The dyspnea becomes more accentuated. Coughing grows intolerable by night and day. The tongue is coated. The liver is painful on pressure, exceeding frequently the costal cartilage. The spleen is not always palpable. We observe anorexia and sometimes diarrhea, but no night-sweats. The pulse becomes soft and the pulsations uncountable.

The effusion in other serosae is evident and sometimes voluminous. The urine contains albumen. The adynamia is extreme. Cachexia appears and death follows, if a saving treatment is not adopted.

The whole process varies from 30 to 50 days.

The ophtalmo-and cutireactions exclude KOCH's bacillus, as well as the researches in the sputum, made with strict and exacting methods.

The research for *Oidium brasiliense* gives positive results.

In one of our cases we interfered in the second stage of the acute evolution, administering only 2 gr. of iodide of potash, by gastric way.

This therapeutical reserve was imposed by the severe conditions of the patient, whom the rapid evolution of the disease had evidently reduced to the extreme of organic distress.

The symptomatical therapeutics had already been exhausted, before the diagnosis of pulmonary mycosis, caused by *Oidium brasiliense,* was made. As soon as this diagnosis was confirmed, the treatment with iodides was called for, as a decisive and heroical medication.

As to its results, thy are illustrated by the behavior of the patient who, considering himself cured, resigned, of his own free will, the rest of the leave, granted for treatment, and reassumed his place in the ranks, departing, in millitary service, for a place near Bello Horizonte.

In these cases we observe, besides the severe pulmonary lesions, other ones of equal importance in other organs.

The whole organism is affected. In the second stage the disease is manifested by attack on the whole line. In the acute form there is septicemia. We already isolated the fungus from human blood.

The oidiomycotic septicemia in man is similar to that observed in animals.

Much before this interesting verification, which throws a strong light on the clinical forms of the human disease, the facts observed in our laboratory, made us already expect its possible occurrence in man.

In the saguin *(Callithrix jacchus* L. 1766) death follows within 22 hours, accompanied regularly by polyserositis and generalisation of mycotic infection.

Besides this hyperacute form there is another one, also generalized but secondary, in some marmosets *(Hapale penicillata)* and, principally, in rabbits. Here the simple acute evolution often lasts 6 days, contrasting with the chronic forms of the experimental disease, with protracted evolution and duration varying from several months (3 or 4) to more than a year (cavernous processes in the rabbit).

The acute form of the disease in man does not exactly represent a form of pure septicemia, as happens in the saguin. In the marmoset it is a septicemia from the beginning, without predilection for any organ, or, more exactly, adapting itself to all organs, from the first manifestations.

In the acute form of the human disease we observe the same as in rabbits, after intraperitoneal injection. It attacks the lungs firstly and intensely; the fungus, however, may be isolated from other organs and even from the blood. We find similar facts in other microbian infections of man, as, for instance, in highly febrile bacillary pulmonary tuberculosis, either chronic or acute.

Chronic forms.

The first period of the "manifest disease" (chronic form) may include, besides the fundamental pulmonary symptoms, the above described serositis. Effusion here, as a

rule, takes only place in one serosa. What especially characterises this period, as well as the following ones, is the hemoptysis, which does not show a violent character. There are mild, sanguineous discharges, true hemoptoic sputa, which only yield to iodides. Such patients do not show thoracic deformation and are well built, many of them even muscular. They are only pale and have always a foul breath. The emaciation only appears in the last periods of the disease. In contrast with this appearance, the auscultation reveals phenomena, which clearly indicate the pulmonary lesions. The patients complain of vague thoracic pain. Coughing always accompanies this period, but has nothing characteristical. Sputum is scarce; only in few cases is it abundant from this period, and, moreover, of an appearance worth remembering. It is thick, clear, full of air, and mixed with numerous small brick-coloured masses, altogether similar in aspect to the sputum of pneumonia; we miss, however the viscosity of the latter. Sometimes a light brown colour prevails in the expectorations. In about twenty of the examined cases only twice was ROGER's reaction found positive in the sputa, which teemed with *Oidium brasiliense*.

The microbiological research of KOCH's bacillus, the cutireaction and the ophthalmoreaction by tuberculin and WASSERMANN's reaction are negative. The reaction for *Oidium brasiliense* (fixation-and intradermal reaction) are positive. In febrile cases the curve is not characteristic. Sometimes the tracing reminds one of those of bacillary tuberculosis in the period of fusion. We also observed febrile patients with night-sweats, insomnia, palpitations and general indisposition. The patient complains, in the morning, of exhaustion and weakness caused by want of sleep. There may be dyspnoea caused by exertion. The examination of the urine generally gives no positive indications, unless albumen be found. The presence of this substance in the urine makes the prognosis severe, even in this period.

Careful percussion of the lungs reveals an incomplete or complete dullness in varying regions. The initial seat of the lung disease is a very interesting question.

These initial foci of the disease are localised in the apices, in the middle, in the bases or in different places of the lungs. The localisation in the apex causes a dislocation of KROENIG's lines in the direction of the lesion. The limits of this incomplete dullness are vague, whatever be the localisation. The auscultation reveals an appreciable modification in the respiratory phenomena. Harsh inspiration, faint vesicular murmur interrupted inspiration, sub-crepitant stertores are constantly observed while-auscultating the foci of the lesion.

These foci, when rather intense, may remind one of "WEIL's disease", if time and some symptoms did not place them nearer to "RENON's disease" (slow form). The complete sum of clinical facts, including the results of treatment, separate it not only from these congestions, but also from "WOILLEZ's disease" of rapid cycle, as well as from POTAIN's pleural congestion. The clinical syndrome accentuates itself in this direction, principally when the disease draws towards the second period. We abstain from referring to the physical signs, we might call *indirect*, because the tracheo-bronchial adenopathy and the pleurisy were already dealt with in another place.

The examination of the digestive system in the first period of the chronic form of the manifest disease reveals, frequently, slight and easily cured disturbances. The spleen may increase in size, the liver is often painful. The circulatory and the nervous systems (central and peripheric) show, as a rule, normal conditions.

The 2nd period of the chronic form of the manifest disease has two different aspects. It must be understood that we do not establish mathematical divisions (always very precarious in practice) of the evolution of the pulmonary lesion. The 2nd stage of the mycotic pulmonary lesions is divided in

two different processes (which do not exclude mixed forms). The first process tends to hepatisation, the second one to destruction (caverns).

The human pathological anatomy already proved the exactness of this assertion. The experimentation confirms exactly what we verified by the observation of patients. We produced the congestive process in rabbits, monkeys, rats and guinea-pigs. The caverns were obtained in rabbits.

The *congestive process* (the most common in experimentation) results from the extension of the primary focus or from the fusion of some foci. Clinical observation reveals the appearing of other signs, not found in the first period: the increase of the vocal vibrations, verified by palpation and auscultation, larger extension and higher number of crepitant stertores. When the conglomeration is situated at the apex, there is often murmur and dullness at the base, with abolition of the vocal vibrations, pleuritic attritus in deep inhalation and egophonia, indicating participation of the pleura. In the focus of the congestive lesion, there is first prolongated expiration, which, later on, becomes granular, narsh, sibilant, hollow and finally bronchial. This last is not constant, but almost limited to the 3rd period of the congestive form.

In the 2nd period one may also find the so-called pseudocavitary breathing, frequent in the common congestive processes of the lungs. These signs, in course of evolution, may be followed bv others of more or less voluminous effusion in the pleural cavity. As to the general symptomatology, there is not abrupt change from the 1st into the 2nd period. There may be dyspnoea and vague thoracic pains. There is always more or less violent coughing, abundant expectoration, constant hemoptoic sputum with the appearance observed in the first period, yielding only to iodides.

In the 2nd process of this period, which is destructive and tends to cavern formation, things pass in an entirely different way. There are clinical signs which make this period a true bacillary tuberculosis of the lungs in full secondary evolution. Such was a case we first saw and which, after excluding the idea of tuberculosis or syphilis and establishing the diagnosis of mycosis, was cured by exclusive, though energetic, treatment with potassium iodide. The foci of destruction are, generally, accompanied by a sequel of ominous symptoms. The expectoration is very abundant. The patient "is reduced to sputum." These sputa are permanent and hemoptoic. There is coughing and fever. Anemia is pronounced. The percentage of red blood corpuscles and hemoglobin is low. Adynamia appears. Where crepitant or sub-crepitant stertores were prevailing, the auscultation now reveals mucous stertores "humid crepitation". The dullness is extensive.

In some places there may be pleural attritus. The respiration is harsh, bronchial, sometimes very loud. The auscultation reveals, sometimes, small foci of crepitant stertores, not rarely scattered over the limits of the dullness. One more step will lead to formation of cavernae. Amongst many other symptoms, shown by the patient in any form of the 2nd period, is fever. It is irregular, with various remissions, accompanied or not by profuse sweating, but never reaches to severe pyrexia. There is also concomitant tachycardia. ROGER's reaction was only once positive in the sputa of these patients. As Dr. MARCELLO LIBANIO noted, the diazo-reaction is frequent and repeated in the urine of these patients. The examination of the other systems reveals: spleen swollen, liver painful, exceeding the right costal border 1 or 2 inches, gastro-intestinal tract with little accentuated and easily cured disturbances. Neither the central, nor the peripheric nervous system show any lesion.

For the patient now begins what may be called *the third period of the chronic form of the manifest disease.* In the congestive forms, the lesions are enormous. One lung is congested from apex to base. The other one has still additional foci variously situa-

ted. Respiration takes place in a very reduced space. The dyspnoea, which ought to be violent, may appear reduced or almost absent, if the organism has time to adapt itself. In the hepatized regions the dullness is complete. The duplicity of the lesion makes a comparative percussion difficult. The intensity of the changes are, however, recognized by comparison with unaffected regions.

The thoracic vibrations are increased. There is bronchophony, tubal and sometimes pseudo-cavitary breathing. In several places of the injured lung, auscultation reveals large foci of crepitant stertores. The sputa are abundant, with the appearance already described (always with blood). Permanent coughing. In the 2nd variety of the 3rd period, leading to cavern-formation, the symptoms vary according to the size of the caverns. The cavitary signs depend on the size of the cavern: they are the "bruit du pot fêlé" on percussion, gargling, cavernous breathing, pectoriloquia and even amphoric sound on auscultation, in one or both lungs. The lungs show, furthermore, various zones of fusion, and, in some places, reduced foci of crepitant stertores.

The general condition of the patient in the 3rd period is very bad. The paleness is intense and emaciation extreme. *Facies* with hollow cheeks, zygomatic arches prominent eyes sunk and without life, viscous sweat on face and hands. Diminished physiognomic mobility. Permanent coughing. The temperature rarely shows the character of hectic fever; as a rule, it follows no certain type. It drags on within the lowest degrees of fever and falls again to normal state; one day it rises, to fall the next and to disappear for a long time. Expectoration is abundant. Hemoptoical sputa are persistent. The serous cavities may contain abundant fluid. There is polyserositis.

There are symptoms of pericarditis with effusion; also symptoms of pleural effusion and ascites. Dyspnoea variable. Liver swollen and painful. Spleenvolume increased. Percentage of hemoglobin and red bloodcorpuscles distinctly lowered. Tachycardia. Pulse weak, arrhythmical. Urines scarce, red, with or without albumen and with positive diazo-reaction (MARCELLO LIBANIO). Pronounced adynamia. The patient in this marasmus may feel hungry. In spite of this gloomy picture we succeeded in curing individuals with apical caverns in both the lungs, by exclusive treatment with iodides.

One step further we reach the oidiomycotic cachexia, with oedemas, diarrhea, muscular weakness, cyanosis, trophic lesions. The sputum is almost entirely swallowed. Accentuated dyspnoea, intellectual torpor. In the last periods of the disease the animals show the same picture. The "*Alouatta*" falls victim to a profound marasmus. The organical decadence is extraordinary. We already described this disease in animals in another chapter. After this ressuming of the clinical features there remains for completing this chapter, to discuss the sputum and the parasite in the tissues.

Sputum.

When a sputum, suspected of containing KOCH's bacillus, is examined, as a rule, a contrast stain is made by metyllene blue after the action of acid and alcohol and the washing in water.

The *Oidium brasiliense*, is neither acid- nor alcohol-fast, hence, undoubtedly, it only appears in blue colour. This was how we first saw the *Oidium brasiliense* in the sputum of a woman. The sputum may be examined immediatelv, without preparation or homogenization. In the latter case the method of FONTES must be preferred. In smears of sputum, well made by platinum-wire-loop (in increasing concentric circles and very thin layers) the fungus is seen in two forms: the *yeast form* (common) and the *mycelian form*. We give a photography of a smear of sputum, stained by ZIEHL-NEELSEN's method. We see a true agglomeration of elliptical yeast forms, but do not observe any trace of fine structure. Besides this elliptical form, there is an oval one. They are

identical to those of the initial cultures on LOEFFLER's medium. Rarely they are spherical. In these forms the double outline of the membrane appears with considerable clearness. The yeast forms are sometimes very abundant. Our photograph gives an idea of the degree they may attain. Such sputa generally give, on first sowing, pure cultures, showing typical gemmulating forms. There is no septation. These forms show some details of structure, when the sputum is fixedy by alcohol and stained by GIEMSA's method. The distribution of the chromatin, however, is here of little importance. We never observed the classical aspect of the *Endomyces albicans* (in the smears of material from scrapings of the mouth); but this means nothing, because, as is well known, in post-typhous pulmonary *endomycosis* (GARIN) this parasite presents itself in the sputum only in the yeast-form.

It is a pity that GARIN does not give more details on this form of the parasite. One fact, however, immediately calls our attention. This author says that he did not find mycelian forms in the smears of sputum from patients suffering from pulmonary endomycosis. There are also forms which we only found cited by HANSEN in some yeasts. They are worth noticing.

There exists a real and stainable halo, a gloea, round the yeasts. They are pulmonary forms, detached and expelled by coughing with the sputum. The colour of the gloea is different from that of the parasite. With SAHLI's stain the involucre appears pale purple, whereas the yeast is stained intensely blue. This gloea, observed in pulmonary foci and in certain artificial cultures of the parasite, is a product of secretion of the fungus. HANSEN, who was the first to study it, obtained it by drying the yeast. It is a mean of defense for the fungus (there are other cases known in mycology) and helps in resisting to the reaction of the organism or to an unfavourable medium.

In the *Oidium brasiliense* (sputum) the mycelian forms, which we consider rare, and the yeast forms are seen together, even on the same slide. These aspects of the *Endomyces albicans* and of the *Oidium brasiliense* are very interesting. They indicate a special pulmonary form for both. The preparation, the photography of which we give, also shows that the yeasts are nearly all of the same size (about 3 *micra*). The same forms of the *Endomyces albicans*, found in stomatitis and lung affections, do not present this uniformity nor have they the same size. They rarely reach 8 *micra*, being mostly 5 to 7, rarely only 3 *micra*.

The mycelian forms, found in the sputum, have nothing characteristical. They are fragments of mycelia, similar to those found in the cultures of the parasite. We ought not to confound these mycelian forms with other similar forms, also found in the sputum, though of different nature. The interpretation of these forms of sputum is interesting. The true pulmonary forms are not abundant and are extraordinarily adherent to the pulmonary parenchyma, some of them, however, being detached casually. They are identical to those of the poor media.

What, however, prevails in the sputum, is the yeast form, with rare mycelian, generally bronchial, forms. The bronchi are a less poor medium for the fungus than the pulmonary medium, being similar to LOEFFLER's medium. The fungus, leaving the parenchyma, finds in the bronchial a more apropriate region for its evolution. Besides the pulmonary, there is a bronchial disease. The expectoration shows much larger quantity of bronchial forms.

Once for all, we declare here that our only aim is to expose, correctly and faithfully, what we succeeded in observing, without other intention but to state the truth. Theories, facts or opinions do not preoccupy us in these matters, where one says already a good deal by saying what one saw.

In the tissues.

The research of the parasite in the tissues offers some difficulty, because of the

insufficiency ot means and methods for this purpose. One of the processes, which gave the most positive results, was the following: Fixation of very small pieces of tissues in alcohol-sublimate or formol (10 %). Rapid passage through the media for dehydration in paraffin, melting at 56 or 60. Staining by GIEMSA, picrocarmine-indigo-fuchsin and hematoxylin-eosin. We do not want to explain all we did in this line; however, we may affirm, that we tried all the means of fixation, inclusion and staining. All of these may give cause for objections, in all one may modify something, as in mycology the histological methods are still far from perfect. The parasite presents itself in the tissues in two forms, one of them being the mycelian. Notwithstanding the opinion of some mycologists, the mycelium may be found in the tissues.

The photograph, we give, is typical. It shows sections of pulmonary alveoli, where mycelia are seen, even fructifying, besides some leucocytes. The other form is the yeast form. Typical or not, the latter is interesting on account of its strange aspect. Its exact value may escape, when one is not very attentive. The forms (see the drawings) look perfectly like those of the artificial cultures of GODROWKA. In both forms, only the outline of the spherical or flattened cells is stained and, even so, feebly. Their complex appears as a mosaic.

Some of these figures are similar to those given by GUILLIERMOND, at page 81 of his book on yeasts.

Altogether they remind one of the zoogloeae, which HANSEN studied so carefully. Around the cells, there appears, besides the membrane, a protective mucilagenous or membraniform involucre (a substance much alike fungin or metacellulose). The phenomenon is, to a certain degree, identical with what we see in WILL's cells, but for the difference that here the proper thickened cellular membrane plays the part of protective involucre (GUILLIERMOND, p. 81). Studying the forms of sputa we spent some time in searching for the cause of these forms.

A point, considered capital, cannot be studied too much. In our opinion, the above described forms represent, as a rule, resisting elements like the saccharomycetic forms of the parasite. They are identical with those found in the water of tubes of old carrot- or potato-cultures and on GODROWSKA's medium. The forms of the parasite are much more complicated in the media, sperially prepared for the *Oidium brasiliense*. They are complex, various and abundant in the parts of the tissues, where the fungus gets the upper hand. In such parts, the growth of the fungus substitutes the structure of the parenchyma. When the Oidium expands and invades the tissues, on a large scale, the prevalent form is the mixed one. When there are distant and circumscribed foci of parasites and the struggle between the parasite and the tissue ends favorably for the latter, the prevalent form is that of *Saccharomyces*, as happens on poor artificial media. The polymorphism of the *Oidium brasiliense* only puzzles observers not versed in mycology. The facts prove a close connection between all the forms of the fungus. These yeast-forms, forms of resistance, are common in lungsections. The classical yeast-forms do not show anything special. The mycelium is very similar to that of certain cultures of the fungus. Examining a hangingdropculture (see the photograph) one gets the impression of seeing the parasite as in certain sections of the human lungs or lymphatic glands. There is a cultural form of mycelium, whith we did not find in the tissues. It is broad, rich in granules and poor in conidiospores. Our photograph shows many places where the network of mycelium is remarkable.

The mycelium form is cylindrical, with or without a few septa. There are pseudomycelian forms, either rectangular or cylindrical. We may observe broader mycelia (5 *micra*) in the inner part of certain dilated bronchioli. Some mycelia, seen in sections (specially of the lungs), enclose small and distant granules.

The rectangular pseudo-mycelian forms are formed by 4 or 5 cells, united in a chain. The size of the elements is marked by septa of varying thickness. Between these the cells present one and sometimes two granules. This may be seen in the center of the aglomerations of the round or polygonal cells. Almost always the material from the tonsils shows yeast-forms, which are identical to those of the sputum. The mycelian form here is rare and ascospores were never seen. No tonsiltissue suitable for sections was obtained. The intercurrent infections by the very rich and varying flora of the mouth interfere with the interest one would find in these lesions. We believe that, once the tonsils affected and penetrated by the fungus, the *Oidium brasiliense* invades the lymphatic glands, as also happens with KOCH's bacillus.

In section of lymphglands the mycelian texture is much like that of the lung. This verification, made in deep-lying glands of various systems and repeated in all details by experiments, is a convincing proof. The abundance of the Oidium in these tissues is remarkable. We found the same conditions in animals. In the lungs of monkeys *(Hapale, Alouata)* the forms resemble those of the human lung. We obtained lesions in the tracheo-bronchial and mesenteric glands of some *Callithrix* and rabbits. The fungus here shows an accentuated polymorphism. In further studies we may treat this matter with more details. For the present it is enough to affirm that the *Oidium brasiliense* is found with these features in lungs, lymphglands and tonsils.

Recapitulation of the lesion.

Our post-mortem examination on patients, victims of oidiosis, wholly justify our conception of the evolution of the lungdisease, formed from clinical observation.

Macroscopical lesions.

The general aspect of the dead bodies indicates an extreme emaciation. We give copies of the records of two post-mortem examinations, which are clear enough to avoid any misunderstanding. Omitting unimportant details, we limit ourselves to the essencial points.

Post-mortem examination N. 1.

Made on 19—7—915 between 2 and 3 hours after death.

External inspection: Male, colour black, probable age 30 years. Extreme emaciation. Complete rigor mortis. No spots on the surface of the body. No liquid escaping from the natural cavities. Pupils equally dilatated.

Internal organs: The central nervous system (complete) apparently normal; sections of the organe do not show anything abnormal.

Trachea: full of abundant clammy mucus. Tracheo-bronchial glands swollen, forming a chain. Remarkable gland agglomeration on an average level with the line, uniting posteriorly, the inner ends of the clavicles; to the right of the median line and in front of the vasculo-nervous bundle of the neck and of the trachea is a striking conglomeration of lymphglands. One, of them is notable by its size, equal to a large nut, and its grey colour. The pneumogastric nerve, behind these glands, is compressed and desviated in a large curb. The glandular volume was remarkably increased in the direction of the pulmonary hilus. The consistency of the glands is hard, firm, even ligneous. They are grayish-white on section. No caseous substance.

On the right the trachea is compressed by one of these masses. The glands of the neck are swollen.

Left lung strongly adherent to the thoracic wall, has to be detached by scissors. There are adherences on all the faces, making the extraction difficult. Colour dark-gray, with reddish rays. Complete hepatisation. Adherences between the lobes. Large and small bronchi full of purulent, reddish-yellow fluid. From the surface of section escapes a purulent reddish fluid. Apex with an oval cavern of about 2 cc. at its largest,

and 1,5 cc. at its narrowest axis, replete with fetid, dark-brown fluid. No portion of these parts sunk, when thrown into a large vessel containing water.

Right lung: Adherent, as the left one. Aspect similar to that of the left lung. Palpation and section give analogous results. An apical caverna has the same fetidness and nearly the same size, as that of the left lung. This lung also shows other smaller cavernae in the same region, all full of a reddish-yellow fluid.

Heart: small, of firm consistence, full of dark semi-coagulated blood. A few white clots. The valves shut well. White, milky spot of about 3 ccm. on the anterior face of the left ventricle.

Endocardium smooth and brilliant in the cardiac cavities. Valves moveable, without granulations. Pericardium thick, containing 170 gr. of citrine fluid. Aorta (ascending portion, arch and descending portion) normal.

Liver: weighing 1440 gr. Section easy, showing the outline of the lobules. Gallbladder full of bile, the duct permeable.

Spleen: small. Capsule easily detached. Consistence firm. Surface of section of the colour of coffee-dregs, with white, resistant striae, forming a network.

Kidneys: Capsules easily detached. The surface of the section shows the two substances, both pale.

Suprarenal capsules: wholly desorganised. No caseification. They are very voluminous.

Pancreas: apparently normal, outside and inside.

Stomach: full of dirty-yellow fluid with suspended solid particles. Mucosa thickened, intensely red. Mucus thick and viscous, covering the mucosa. Sub-mucosa intensely red.

Intestine: Slight adherence of the loops. The *peritoneum parietale* thick, humid, brilliant. Mesenteric glands all affected, voluminous, their size varying from that of a pin's head to that of a plum. These glands have the same consistence and aspect, as the above described ones, at the level of the tracheo-bronchial chain. They are, however, not so voluminous.

Liquid fecal matter in the whole extent of the last part of the intestine. Mucosa reddened in some places. Appendix free. Intestinal catarrh abundant.

Bladder: full of citrine fluid.—

Lifting the sternocostal *plastron*, a normal quantity of adipose tissue appears.

Thyreoid gland: colour of muscle, flattened against the trachea. It is thick resistant and apparently not increased.

Post-mortem examination N. 2.
(Oct. 4th, 1913.)

Body of female, apparently of 30-35 years. Cutaneous tegument brown. Rigor mortis incomplete. Purplish-red spots on the sides of the neck and the shoulderregion. Very emaciated. Deep and large epidermical defect at the level of the right crural fold. Abdomen prominent. Eyelids sunk. Lips purplish. A reddish-yellow and viscous fluid escapes from the mouth and the nose, increasing in quantity on every movement of the body. Corneae transparent. Pupils equally dilatated.

Heart: floating in more or less 800 gr. of citrine fluid. White milky spots scattered over the surface of the organ. Apex of the heart in the 6th left intercostal space, exceeding the left mamillary line for the breadth of 2 fingers. Volumen of the organ remarkable. Consistence regular. Valves of aorta and pulmonary artery normal. Cardiac cavities full of dark red semiliquid blood. Endocardium smooth and brilliant, the valves without granulations. On surface of section nothing remarkable.

Right lung: dislocated towards the bottom of the thoracic cavity, which contains about 1 litter of very red fluid. Parietal pleura thick, intensely red. Visceral pleura also thick and reddened. The organ quite covered by a fibrous coating. Adherences, on tthe whole of the organ, with the inner sid of the thorax wall and with the diaphragm. Adherences between the lobes. Lung wholly hepatized, small, wine-red re-

sistant on palpation; no crepitation perceived. Surface of sections intensely red and emitting, on compression, a dark red fluid. In some places (base) the pieces of tissue, when cast into water, sink to the bottom.

Trachea and bronchi full of reddish- yellow viscous fluid.

Left lung: also dislocated towards the bottom of the pleural space into the costo-vertebral cavity. About one liter of citrine fluid in the pleural cavity. There are no adherences. The organ is small and hard, though less so than on the right side. Crepitation perceived on pressure. Colour somewhat brown with reddened stains. A frothy reddish fluid escapes from the surface of section.

Peritoneal cavity: filled with about 4 liters of citrine fluid. Peritoneum thickened, showing dark-brown spot at the level of the umbilicus to the left of the median line. Epiploon large, covering almost all of the intestinal mass.

Liver: large, resistant and hard, but easy to cut. Surface of the organ and of the section nutmeglike.

Spleen: large. Consistence normal. Surface of section with the colour of coffee-dregs, presenting a dense network of white, resistant trabeculae.

Kidneys: Capsules easily detached. A dark red fluid escapes from the intensily red surface of section, even without pressure. Surface of section shows almost no difference of the parts.

Stomach: empty. Mucosa reddened in some places.

Intestine: The last portion full of semiliquid fecal matter. Mucosa slightly reddened in some places.

Pancreas: without perceptible alteration on external or internal aspect.

Appendix: free and permeable for gases.

Uterus: small, hard, resistant. The annexa without anything remarkable.

Bladder: empty. Inner surface pale white with some red lines.

Suprarenal capsules: normal, no apparent alteration.

Thyreoid gland: not hypertrophic; flattened and resistant.

On lifting the sterno-costal plastron, a normal amount of adipose tissue appears.

Microscopical lesions.

We will now describe the histological sections of the lungs only, as we have not had time enough to make a complete study of the lesions in all the organs; even the examination of the lung, here described, is not finished.

Sections of the lung showed, on examination with low power, several features worth recording. When the invasion is strong, we observe enormous foci, intensely stained and scattered over the parenchyma. The structure of the lung disappears at the site of these foci. Even with oilimmersion (Obj. 1/12, oc. 4 apochr.) it is impossible to see anything but parasites and, mixed with them, a large number of red and a few white blood corpuscles and, mostly between them, a dense network of fibrin. Around these large foci the pulmonary tissue is very much altered. The fungus does not end suddenly with the agglomeration. From the greatest thickness in one part of the microscopical focus we gradually pass to other ones, where the parasites are less crowded and the destruction of the tissue less intense, until, finally, we reach a zone, where a mixture of tissue and fungus is visible. These foci of parasites and destruction are almost always full of the pigment of the fungus itself; the nature of this pigment we were not yet able to determine, either in the tissues or in the media of artificial culture. We consider it, however, closely related to the pigment of certain sporotricha.

Another interesting object is that of lung sections, where the invasion is less intense. We see small foci, where the agglomeration of the fungus is also smaller (see photographs and drawings). We observe numerous small foci, scattered over the parenchyma. The contrast is the more striking, as, outside and between these foci, there are corresponding

foci of red bloodcorpuscles. They prove that the presence of the *Oidium* in the tissue does not result from a cadaveric invasion and postmortal vegetation of a common fungus of the ordinary bronchial flora, without relation to the human disease. They indicate a close connexion with the evolution of the signs of disease in the individual, from whom these sections were obtained (congestive form). The important thing is to recognise the parasite in these foci. We give drawings and photographs, with oil immersion of forms taken from tissue and from artificial cultures, which need no discussion. Certain sections with little invasion of parasites, examined with low power, remind one, *mutatis mutandis*, of pulmonary sections with microscopical foci of bacillary tuberculosis in its granulation form.

However, the anatomical characteristics of the tubercle are not observed. The sections, stained by Giemsa's method (with differentiation) and by picrocarmine-indigo-fuchsin, show the structure of these foci more clearly. The aspect is remarkable. It seems impossible to distinguish the structure of the foci, when stained by hematoxylin-eosin. They resemble here a uniform and finely granulated mass of rose colour. On examining with immersion, however we see their real constitution. By the methods of FONTES or ZIEHL-NEELSEN we see neither KOCH's bacillus nor giant-cells, but exclusively the resisting forms of the *Oidium*. And if, to those, who are not yet used to the observation of this aspect of the fungus, the foci are not favourable localisations for recognizing the object seen, thery are intermediary zones where any doubt ceass (see photographis and drawings). The hypothesis of MUCH's granular tuberculosis which, in the tissues more than in the sputa, only the trained eye is able to distinguish, does not come in here. We never succeeded in observing such elements. Leaving aside this negative proof, we have that of the experimental inoculation of the guinea-pig. MUCH's tuberculosis makes the guinea-pig tuberculous. We never obtained this result with sputum, nor with triturated suspect organs, obtained by post-mortem. In these small foci the pulmonary tissue is hardly recognised between the network of parasites.

Around these foci, as well as around the larger ones, the alveoli are full of parasites, leucocytes and red-blood corpuscles, interwoven in a dense network of fibrin. In some no open space remains, in others there is always some air in the alveolar cavities.

The same happens in the bronchi. Only few epithelial cells are seen. There is no desquamating alveolitis. The capillaries appear dilated and full of blood. In the region of the foci, the intra-alveolar septa disappear or become very thin. Outside of these foci, there are a few places where the alveoli appear dilated.

In certain foci there are places, where the tissues appear necrotic, with an indication of cavities forming. In these parts we see classical yeast forms with double outline and gems. Leucocytic infiltrations around the bronchi or the blood vessels are rare and, whenever found, quite small. The alveolar epithelium is normal in certain parts. In other parts it is found slightly hypertrophic and invaded by lymph elements. Dust cells are abundant and well marked. The histology of microscopical foci shows characteristical features. There are no real subdivisions in zones, as in tuberculosis, syphilis, etc. The presence of the parasite in the pulmonary tissue causes, beside the natural leucocytic reaction, phenomena of congestion. In these foci there is no lymphocytosis, but exclusively leucocytosis, and, especially, a great number of red bloodcorpuscles, inside, about and even distant from the chief localisation of the parasite.

Diagnosis.

The diagnosis of the *oidiosis* finds now-a-days a certain and unerring confirmation in the microbiological and anatomo-clinical facts. Beside many others, there are two principal sources of error, which we must

avoid in order to arrive to this assurance: tuberculosis in its innumerous and complicated manifestations, and syphilis, not less capricious in its localisation.

To exclude syphilis and tuberculosis, we recurred not only to direct researches, but also to the multiple forms of immunity reactions, informations obtained through the use of x-rays, the specific immunity reactions for the *Oidium brasiliense,* the inoculation of sputum and triturated organs in guineapigs and even to certain features in the clinical syndromes of oidiosis.

We carried the researches for the KOCH bacillus as far, as possible in the actual state of knowledge. These researches were always negative in the various stages and forms. Beside the most careful research of KOCH's bacillus, we applied the cutireaction and the ophthalmoreaction as additional means of diagnosis. These reactions proved insuccesful, such corroborating the results of our researches of the bacillus.

We found, furthermore, differential elements in the clinical picture and in the treatment. The foul breath, the aspect of the sputa, the continual persistence of blood in them during all the periods and in all the forms of the disease, the singularity of some initial and later pulmonary localisations, which never spare the serosae, the tendency of some cases to produce a "congestive disease", with characteristic features, form and evolution, a thermic curve, generally uncharacteristical, or, more rarely, resembling that of tuberculosis, anamnesis without reference to lesions of the respiratory system and a family history free from tuberculosis constitute diagnostical elements, which are corroborated by the results of the treatment.

The influence of treatment is the more striking, as we see patients, with strong signs of pulmonary congestions (for whom, if they were suffering from tuberculosis, the treatment with iodides would be formally contra-indicated) recover from their marasmus under full doses of sodium or potassium iodide within a few days.

The differential diagnosis with syphilis, is more difficult, though not less exact. Cases of pulmonary localisation of syphilis are relatively rare. This localisation of syphilis has a predilection for certain pulmonary regions, and, according to some authors, certain lungs. We did not find any predilection in the patients suffering from oidiomycosis. WASSERMANN's reaction is always negative in these patients, nor do they present clinical signs of syphilis. The anatomo-pathological lesions do not speak for syphilis. Mercurial or arsenical treatment give absolutely no result. However, we must not forget that the treatment is not quite a wholly reliable reaction for proving the absence of syphilis in some suspect cases and BALZER was right when, cautious and provident, he warned us against the errors, to which we may be led by the results of the specific treatment. Encouraging results may be seen in syphilitical, and, what is more, in not syphilitic consumptives, and these results led DOCHMANN to establish the methodical treatment of pulmonary tuberculosis by injections of calomel.

For our part, we affirm, with almost experimental proofs, that the test treatment for syphilis, is able to improve pulmonary affections of not syphilitic patients.

Beside other pulmonary affections, there remain the mycoses. The historical recapitulation of the lung diseases, produced by fungi, is a chapter quite sufficient for a paper. We shall only mention the capital points, which, if not discussed and excluded, might give cause for doubts. A long time ago BENNET already mentioned, in "Brittanica", the presence of a fungus in the sputum of patients of pneumonia. He called it *Oidium pulmoneum*, giving it the name of the organ, from which he thought it proceeding. In the recent mycological litterature we find that there are doubts as to the genus *Oidium* of BENNET and the species *pulmoneum.* This paper helps us little. The genus *Oidium* to-day calls for more discriminating details and characteristicals than those given by BENNET. The origin from

the lung must be put aside, on account of the initial and rudimentary knowledge of mycology at that time. In the systematic mycology, however, the place was filled, although the description of BENNET's fungus may fit equally well an *Endomyces*, a *Mycoderma* as and *Oidium*. Not less doubtful is the origin of the parasite, wich, in want of positive notions, may have come from the mouth, bronchia or lung.

The pulmonary actinomycosis (Discomyces), either primitive (rare) or of cervicofacial propagation (common), has a definite aspect in practice and in microscopy. The diagnosis in most cases imposes itself. To the integrity of the apices, the predilection for the bases, the rarity of hemoptysis, the usual absence of adenopathy (primitive cases), the remarkable tendency to propagation (liver and spleen) are added the cultures, smears and inoculations for excluding decisively the pulmonary actinomycosis; this exclusion becomes still easier, when the pulmonary follow on cervicofacial lesions. Clinical experience, however, registers cases, in which the differential diagnosis was difficult.

As all the chronic lung affections, they resemble much tuberculosis, pulmonary sclerosis and chronic bronchitis. The apical localisation, the hemoptyses, the physical signs of sclerosis or ulceration in the lungs, beside the combination of nocturnal sweats and irregular fever, might often lead the practitioner in error, if the fetid purulent expectoration without KOCH's bacillus, without *Oidium brasiliense* and with characteristical elements of actinomycosis, did not help to establish a speedy and certain diagnosis. The laboratory gives the final decision.

ROGER & BORY presented, in 1909, an observation of pulmonary mycosis, caused by a fungus, which, in their opinion, was an *Oospora (pulmonalis)*.

The observation is complete: post-mortem, anatomo-pathological and clinical examinations, were made. The lesions consisted of a classical pseudo-lobar broncho-pneumonia and of a series of cavernae. The fungus was well studied.

According to the description of the authors, the parasite is a "microsiphonated hyphomycete of the genus *Discomyces*, and, therefore, all confusion is excluded, even if the fungus is erroneously considered as not pertaining to this genus, but to the genus *Oospora* (of WALROTH 1883).

The parasite of thrush, the *Endomyces albicans*, is, of many other fungi, the one which causes probably ihe greatest confusion. The characterisation of this fungus is today relatively easy, especially after the studies of VUILLEMIN. This fungus is exceptionally localised in the lungs. It generally occupies the mouth, the upper air tubes or even parts of the digestive tract. Some authors, however, deny the autonomy of a pulmonary mycosis, caused by *Endomyces albicans*.

It is the parasite of depauperated convalescents of tvphoid fever, of patients with diabetes, tuberculosis etc. Living as a saprophyte in the buccal cavity. it may, when conditions of organic inferiority are given, reach the higher respiratory tubes and even, according to some rare observations, the lung.

REBATTU & GARIN found, in 1911, only 5 observations of pulmonary mycosis caused by *Endomyces albicans*.

GARIN, in 1914, made a profound study of all the affections caused by this fungus and discussed the question of the cultural forms of the *Endomyces*. There is a certain likeness between the evolution of these forms and that of *Oidium brasiliense*, but the morphology differs. In the clinical post-typhoid pulmonary forms GARIN finds only yeasts in the sputum. We found also filaments in oidiosis. We repeat that the yeastforms of the *Oidium brasiliense* express a well defined fact, the struggle of the parasite, be it caused by the poverty of a cultural medium (old cultures, GORODKOWA's medium and tissues), or the adaptation to a fresh medium (recent form in fresh sowings).

We do not give much importance to the *macroscopical* morphological differences of cultures between the *Endomyces albicans* and the *Oidium brasiliense*; modern mycology tends to consider these varying and uncertain aspects as of secondary value. We lay stress on the microscopical morphology and, what is more, the biology of the parasite. Here the differences concern the exclusive vegetation of the Endomyces in some acid media, of the Oidium in other alcaline media. Gelatine is liquefied much sooner by the Oidium. This difference is still more striking for those, who denye to the Endomyces the power of liquefaction. The precocity is also manifest in the coagulation of milk. The table of fermentation, we give in this paper, is another valuable differential element and should be compared with that, commonly given in papers on *Endomyces albicans.*

The *Oidium* kills the common laboratory animals by any way, even without scarification of the mucosae. The *Endomyces albicans* has not this high pathogenic power. The experimental disease is different, though showing some points of contact, as is the rule in nearly all the mycoses of a certain group.

The human disease, caused by the *Endomyces albicans* does not show the same characteristicals, as that caused by the *Oidium.* The manifestations of human endomycosis are sometimes small post-typhoid abscesses, at other times bronchitis or pneumonia, the latter two forms according to GARIN's paper, already cited.

The morphology of *Endomyces albicans*, in the contaminated material, in cultures, etc., has today a classical aspect. Our description of the *Oidium* makes comparison and distinction easy. It is enough to cite the potatoe-culture. In these cultures the *Endomyces albicans* shows a rounded form, and never, or almost never, do we see filaments.

The contrary happens in the *Oidium brasiliense.* These comparisons, even if they seem only to establish the differences from one Endomyces, are sufficient to secure the distinction from a group of them.

We refer to the studies of CASTELLANI, of LOUIS GUEYRAR & GUY LAROCHE, of GARIN, BABINSKY, DAIREMA, GIUSEPPE CAO, etc., which show the distance between the species of *Endomyces* and the *Oidium brasiliense.* We recommend CASTELLANI's synthetic tables of 6 species, he studied in Ceylon, and the other one of 13 tropical species. In CASTELLANI's work in Ceylon some points necessary for accurate diagnosis are missing. At any rate, after excluding tuberculosis by the sputa, he characterises a fungus (Endomyces) which does not coagulate milk, nor liquefy gelatine; the fermentation and cultures also are wholly different from those of *Oidium brasiliense.*

GIUSEPPE CAO also studies the complex of what he calls *Oidium* and of the disease it causes. He divides these parasites in 4 groups, taking as base of his classification cultures on gelatine and in milk, the fermentative and pathogenic power, the morphology, the origin of the fungus and even the mode of action in the infected organism.

In all these groups, even in those causing diseases in man, we do not see anything similar to the *Oidium brasiliense.* The paper of GUEYRAT & LAROCHE refers to a fungus, which, though not found in the lung, might cause doubts. The biological proprieties, the experimental disease (all the organs of the rabbit are affected, with exception of the lung) differ from those of the *Oidium brasiliense*, as well, as from those of the *Endomyces albicans.*

There is still another point to elucidate. We give in this paper photographs and drawings of tissueforms of the fungus, which are real yeasts. We already gave our opinion on these forms. In North America LORENA M. BREED, alone or in collaboration with others, described innumerous cases of a lung disease, caused by a yeast, which by form and culture is alike to the *Saccharomyces cerevisiae.* The paper of BREED of 1912, was completed by that of 1913, in which the author reports post-mortem exami-

nations on patients and studies of the lung lesions. Treatment with iodine gave very good results. This paper proved, undoubtedly, the pathogenic action of a rather wide-spread yeast in man. The fact, that it is a yeast, is enough to avoid confusion. The cultures of yeasts are easy and, if, on first sight, a beginning culture of the *Oidium brasiliense* may resemble macro-and microscopically that of a yeast, in the further evolution of the parasite in artificial culture there appears immediately the double differentiation, micro- and macroscopical. In the tissues, the yeast presents only forms of *Saccharomyces*; not so the *Oidium brasiliense*, which, in the tissues, shows the mixed form, though in some places the yeastform or the mycelian form may prevail. The experimental disease has not the same aspect as that of the *Oidium*.

Speaking of yeast forms of the *Oidium* (tissue) the idea of the "pulmonary zoogloeae" is suggested. To-day, however, MALASSEZ & VIGNAL's disease is referred to the group of bacillary pseudo-tuberculosis. The germs are *zoogloeae* of bacilli. We give, at the end of this paper, enough litterary references, to definitely elucidate this question.

We shall not tarry for this or any other affection, belonging to this already very vast chapter of human pathology. This disease, as the forms of pseudo-tuberculosis, produced by inert foreign bodies, are distinguished by the evidence of different results in any kind of examination. We need not insist. We shall pass over the references of BEAUVERIE & LESIER to "*Willia anomala*", and a variety of the *Endomyces albicans*, on account of their distant connection with our subject. Also the paper of STEPHEN ARTAULT (1898) who described, in a pulmonary cavern, the *Cryptococcus cavicola*, allied to or identic with the *Cryptococcus glutinis*, does not concern us much, as treating of a form of yeast.

We also limit ourselves to calling attention to the observation of NOEL BERNARD. His fungus is easily recognised; it is allied to or identic with *Rhizopus equinus* and capable of causing a chronic bronchitis. There is no confusion possible. We come now to Dr. IOSHIO KATO's observations in Japan, wich are well detailed and convincing. This author described, in the year 1915, a pulmonary mycosis, produced by a *Leptothrix*. The clinical observations, the experimentation, and the study of the fungus immediately separate this asiatic disease from that produced by the *Oidium brasiliense*. The only remarkable thing is the aspect of the sputa, containing dark grumous particles.

The *Sporotricha* are also able to attack the lung. The human visceral sporotrichosis, however, is uncommon. The pulmonary forms have been observed only in very rare cases and, even in these, we should not forget, that the sporotricha may be found in the sputa of healthy people. The medical literature contains cases, in which the clinical diagnosis of lungsporotrichosis, in spite of the sporotrichum found in the sputum, was not confirmed by careful post-mortem examinations (case of LAYBRY & ESMEIN). The observation of SEGUIN, from Hanoi, however, does not allow us to exclude altogether the hypothesis of pulmonary sporotrichosis. The aspect of the parasite in smears and cultures is, however, classical. This fungus occupies, to-day, a definite, though possibly transitory, place in systematical mycology. It is a conidiabearing *Hyphomyces* of the sub-group of the *Sporotricha* (VUILLEMIN). For deciding the question, we have also the immunity reactions, to-day of common use in laboratory work.

Already for some time, cases of visceral lesions and even septicemia, caused by parasites, conventionally called *Blastomyces*, frequently appear in pathology. First of all, we wish to note the discussions versing on this group, which, till of late, was uncertain, inexact and vague. The recent papers of VUILLEMIN are tending to restrain and, apparently, define it.

The Blastospores are fungi, which may be localised in the lungs.

Leaving alone such cases, as may be considered secundary pulmonary localisations, on account of the more or less generalized blastomycetic infection, there are others (case of ALBERS), in which the primitive infection seems to be located in the lungs.

Not attributing much importance to the exceptional rarity of such exclusively pulmonary diseases, we observe, at first, with the development of the infection, the rapid dissemination of the fungus in the organism. The cutaneus or ganglionic lesions, besides those which, in these case, as a rule appear in other viscera, should always contain material for elucidating the diagnosis. The clinical symptomatoly also is said to be more complicated. Besides, in all these cases, the sputa furnish pure, or almost pure, cultures of blastomycetes. The smears of sputum show innumerous characteristical forms. A mong the Hyphomycetes there is the *Aspergillus fumigatus*, capable to produce a primary pulmonary pseudo-tuberculosis. The fungus is characterized by smears and cultures. Of artificial cultue media RAULIN's fluid is most used. The *Aspergillus bronchialis* is a species of the same genus, but of doubtful pathogenic ation. In the family of the *Mucorini*, there are three species, *Mucor mucedo Rhizomucor parasiticus* and *Mucor corymbifer*, accused as parasites of man. Given the great number of fungi of these species, it is a wise rule to use the greatest care in these diagnoses.

Even so, for our case only the pulmonary Rhizomucormycosis of LUCET & CONSTANTIN is worth mentioning. The pulmonary mucormycosis of FUERBRINGER and the lung manifestations of the generalized mucormycosis of PALTAUF deserve, in our opinion, well founded reservation. The diagnosis of the species is easily made by smears of the lesions and of the sputa, by cultures, and, when possible, by anatomo-pathological examinations. The tracheo-bronchial adenopathy of adenomycosis might, in the begining, lead to confusion with the adenopathy caused by *Oidium brasiliense*.

This adenopathy, according to the discoverer of this new mycosis, has often fatal tracheo-bronchial and nervous consequences.

The phenomena of compression are indicated in some cases, not to mention other symptoms, by a certain amount of expectoration, but here the clinical syndrome is characteristical. So far as we know, there are no exclusive lungsymptoms. The glands of the neck, the submaxillary glands, etc. furnish, by punction, sufficient elements for diferential diagnosis. Immediately after the mycoses, we consider the malignant neoplasms of the lungs.

The primitive pulmonary cancer has, according to MENETRIER, a pathognomic feature: the presence of neoplastic cells in the sputum or in the liquids, retired by punction from pleura or lungs.

The adenopathies, the external tumours, the complex of clinical symptoms, complete the picture satisfactorily. There are cases, though rare, in which pulmonary cancer may be confounded with tuberculosis, in all its forms, and with not tuberculous chronic adenopathies. Of course, confusion is also possible with the tuberculosis, caused by *Oidium brasiliense*. If, however, in these cases, the microbiological researches should prove insufficient for differential diagnosis, there would still be the treatment with iodides. Amongst many other cases, we must call attention to malignant neoplasms with more violent symptoms, the different forms of pulmonary sarcomas. In such cases clinical observation may soon furnish sufficient elements for differential diagnosis.

Hydatic cysts of the lungs also have caused, in adults as well, as in children, confusions with tubercular lesions of the pleura or the lung. The use of x-rays gives a valuable help for this diagnosis. There are also the anamnesis and the clinical examination, completed by laboratory methods. The diagnosis is also helped by urticaria, bloodeosinophilia, expectoration containing membranes or embryonic hooks and the immunity reactions.

The diagnosis is completed by the research of the *Oidium brasiliense* and treatment

with iodides. Among the pulmonary pseudo-tuberculous diseases, there is also the parasitic hemoptysis. The examination of the sputum establishes immediately the diagnosis, showing reddish-brown operculated eggs 80—100 *micra* long, 40—60 broad. The treatment of parasitic hemoptysis is purely symptomatical. The tracheo-bronchial tubes and even the lungs are still affected, primitively or during the evolution of different infections, by various and sometimes severe affections. The minute discussion of the inexhaustible subjects forming the complex, known as pathology of the respiratory system, however, is not our task. For distinction and differentiation we mentioned only the capital points, which are quite sufficient for those who want to see.—Besides those already stated, we sought still for other elements, to corroborate the results of our studies. So we recurred to the phenomena of immunity, in their long and manifold sequels. After examination by direct smears, various stainings and fixations, cultures in *Sabouraud's* and *Drygalski's* media, etc., after inoculations in guinea-pigs, rats, rabbits etc., minute clinical examination, careful exclusion of causes of error for each case, when the diagnosis of tuberculosis, due to *Oidium brasiliense* is almost certain, we may still recur, as to additional proofs, to the specific fixation test and to intradermoreactions. We did not try the mycotic cutireaction on account of the almost unavoidable causes of error, to which such researches are subjected in practice.

Immunity reactions.

The sporo-aglutination, to-day of current use in certain mycoses and of incontestable value, did not give us yet very clear results. Be it due to imperfect methods or to difficulties inherent to the qualities of the fungus, this failure is by itself worth mentioning. The intradermoreaction for *Oidium brasiliense* is obtained by inoculating subcutaneously (in the derma) some drops of an emulsion of the fungus, killed by heat (56° for 1 hour). The vehicle may vary. The reaction is exclusively local. Its simplicity, harmlessness, and rapidity make it a good method for the clinical diagnosis of the species. We tried ityin very numerous other cases of human disease, including tubercular affections (due to KOCH's bacillus), syphilis and ulcers, diseases of the digestive system, adenomycosis etc. The reaction was always negative in the cases, where the *Oidium* was absent.

These results are worth registering, especially in tuberculous affections, due to KOCH's bacillus, and in syphilis. We also applied it in some cases, in which the nature and localisation of the lesions facilitated or contributed to the proliferation of other fungi, and in cases, where the buccal flora showed abundant forms of fungi of a certain group.

Specific intradermoreactions in patients, not suffering from oidiosis, were seen only once in 20 observations, the reaction being only feebly positive. In those of strong vitality the appearance of the intradermoreaction by *Oidium brasiliense* is twofold. In feeble reactions, there is local redness after 24 to 48 hours. This redness is not very accentuated and may be slightly painful on pressure in its center. On the 3rd day everything disappears. In the strong reactions, belonging to the second period of the manifest disease (in any form), the results are different. After 20 to 24 hours, the place of inoculation appears intensely red and painful, either spontaneously or on palpation. A slight prominence is noted in the cutaneous tegument. This may increase in the following 24 hours (see the photography), reaching the size of a lentil. Around the principal point, there is a reddened halo of about 3 cc. This aspect remains unaltered for 72 and up to 96 hours, the reaction then receeding at a varying rate, according to the patient. After 7 days, at most, there remains only a slight desquamation. This intense local reaction is not accompanied by any other local or general symptom. The temperature does not exceed 36,9°. The pulmonary lesions are not modified.

However, we do not expect to obtain

from this reaction a decisive result, knowing what succeeds with similar and closely related forms of mycosis, as with tuberculosis due to KOCH's bacillus, leprosy, syphilis, etc. We have not yet used the reaction, on a larger scale, in diseases, produced by known fungi. We tried it, with *negative* result, in one confirmed and fatal case of adenomycosis and in another of sporotrichosis.

Co-reactions may not be wholly absent in the *Oidium brasiliense.* GOUGEROT, in 1911, carefully studied this matter and concluded from undoubted facts the existence of co-reactions with mycotic sensibilisations. In the disease, we are studying, the intradermoreaction, having the character of a biological test, is not expected to be more than a relative reaction, a diagnostical element; it may indicate, but not warrant the existence of oidiosis.

Besides this reaction, we experimented the fixation-test for *Oidium brasiliense.* While the specific spore-agglutination failed, we obtained remarkable results with the reaction of BORDET-GENGOU. Ours was the classical method, used for such tests. The antigen was obtained by triturating a fungus culture of about 30 days in physiological saltsolution (8,5 0/00). The age and the origin do not affect the result of the test. We prepared large quantities, which were kept in the ice chest. The emulsion was mixed and rich. The trituration was very carefully done, so as to avoid clots, always embarrassing. There was no necessity to filter the emulsion. The preparations, needed for the tests, the experiments and the technical details do not belong to this paper. Only, after obtaining reliable results, did we proceed to the test with human sera.

By substituting, in table 2, the column "suspected serum" for that of "normal serum"., we get inverse results, that is hemolysis. The result is the same, if, instead of normal serum, we use sera of patient with syphilis, tuberculosis etc.

We obtained 100 % of positive results in the cases of oidiosis. We believe, however, that larger number of observations may give us feebly positive results in absence of oidiosis (especially in other forms of mycosis). It is only a question of degree. Therefore an exact dosage was indispensable for a reliable test.

Co-fixations, in this oidiosis, happily will not be a rare exception, but only another example in mycology. We see co-fixation between the sporotricha, discomyces, endomyces, etc. In order to show the degree, at which we arrived in these matters, we copy the words of BEURMANN & GOUGEROT, who say, in reference to patients with sporotrichosis: "It seems that the simple presence of a saprophytical yeast in the throat (a very common fact, especially in consumption) is enoygh to produce, in certain cases, a reaction of mycotic fixation.

Etiology.

We did not study this chapter thoroughly, but the facts, minutely described in the preceding lines, suffice to guide the observer. Anginae caused by the *Oidium brasiliense*, the penetration of the fungus by the mucosa, intact or not, the lesions of the mesenteric and thoracic lymphglands suffice for showing the way.

The fungus, living free and, perhaps, as a saprophyte in the nasal and buccal cavities or in the gastro-intestinal tube, may, in certain conditions, defeat the organic resistance and become a cause of disease.

In a paper, published in 1914, HASTINGS showed, with special care, the way of natural distribution of the fungi, and particulary of one group. Accompanying this minute exposition, one may get an idea of how far this distribution extends and wonder, perhaps, that the diseases, caused by fungi, are not more numerous. In the special case of oidiosis there are more than sufficient reasons for referring it to a fungus, primitively free or parasitical on plants. Oidia or allied fungi are, for instance, observed, with extraordinary abundance on oaktrees. In the sporotrichosis we find the same fact repeated. The sporotricha, pathogenic to man and

animals, descend undoubtedly by way of adaptation from freeliving species. The complete study of the blastomycetes is leading to an other confirmation of this natural descent. Complete mycological researches can only be favourable to this conclusion, no matter which the studied fungus may be.

Treatment.

The diagnosis of the mycosis, caused by *Oidium brasiliense*, once established, safe and speedy cure is warranted. We obtained complete restablishment of patients, suffering from this disease, in more than ten cases. We point out, that in the treated patients the period of the disease varied extremely, from the simple apical lesions and affection of tracheo-bronchial glands to cavern formation in both apices, with extensive breaking down in some other parts of the lung. In some cases we witness real resurrections, the more remarkable, as the prognosis whould be inexorablyfatal, if such cases were due to bacillary tuberculosis.

Table I.

Fixationtest with blood of rabbits, immunized by cultures of the O. brasiliense.

Emulsion of O. brasiliense	Inactivated (56) serum of immunized rabbit.	Complement (1/10)	Inactivated hemolytic serum (1/00)	Washed blood corpuscles of sheep (5%) with physiol. saltsol.	Human syphilitic serum	Results
1) 0,06	0,1	1 cc.	1 cc.	1 cc.	—	No hemolysis
2) 0,125	0,2	«	«	«	—	«
3) 0,25	0,5	«	«	«	—	«
4) 0,5	1,0	«	«	«	—	Total «
5) 1 cc.	—	«	«	«	—	Almost imperceptible
6) —	1 cc.	«	«	«	—	No hemolysis
7) 1 cc.	—	—	—	«	—	« «
8) 1 cc.	—	1 cc.	1 cc.	«	0,4 cc.	Complete «

Note. The tubes completed to 4 cc., except number 8 of the series 1. 4 to 16 h. at 37°. Reading after 2 h.

Table II.

Fixationtest with sera of patients, suspected of O. brasiliense.

Antigen: emulsion of Oidium brasiliense	Inactivated suspect serum	Complement (1/10)	Inactivated hemolytic serum (1/00)	Washed blood corpuscles of sheep (1 %)	Results
1) 0,3	0,3	1 cc.	1 cc.	1 cc.	No hemolysis
2) 0,3	0,1	«	«	«	«
3) 0,1	0,3	«	«	«	«
4) 0,1	0,1	«	«	«	«
5) 0,6	—	«	«	«	Complete «
6) —	0,4	«	«	«	« «

Note. The tubes completed to 4 cc. with physiological salt solution at 8,5 0/00. Reading after 2 h.

In some cases various treatments were tried before. Mercurial injections, "914", "606", so-called detergents, general tonics, besides different forms of diet. Notwithstanding, the disease persisted or went on impressive and dreadful. In our first preliminary note we said that the patient had been treated with large doses of potassium iodide. To-day, on the strength of more observations, we may declare that not only potassium but also sodium iodide (sometimes preferable to the former) exercises on the *Oidium brasiliense* a similar action, as the former shows on the sporotricha.

In vitro, the iodide solutions do not prevent the development of the *O. brasiliense*, even acting for a long time in concentrated solutions (high dose); apparently the colonies do not even appear later.

The iodides have been given by mouth and intravenously. After testing the sensibilitiy and the kidney conditions of the patient, we determined the doses which, wityout reaching the yighest, used in Norty-America (30 and 50 grams), oscillated between 8 e 12 grs. daily. For intravenous injection we employed isotonic solutions, preferring those of sodium. The technique of these injections is well known. We may use common syringes or special dispositions facilitating the operations (see figure), as used by prof. SAMUEL LIBANIO and his assistants.

The vehicle of the solutions for these injections is bi-distilled and recently sterilized water. The iodide is chemically pure (BERTRAND). We always inject very slowly.

After some days of treatment, the aspect of the patient changes. The emaciated, parched and pale face becomes smooth, full and coloured. Anemia disappears. Increase in number of red bloodcorpuscles and percentage of hemoglobin succeeds to diminution of the former and to the low percentage of the latter. When anorexia existed, it was succeeded by a canine appetite and general depression is succeeded by gradual recuperation of forces. Hemoptysis is arrested. The hemoptoic sputum tends to disappear while, on continuing the treatment, the proper expectoration ceases. These modifications are followed by others in the pulmonary parench ma, as shown by physical examination. The lesions regress. One of our cases relapsed, due to interruption of treatment with iodine. (These recidives are frequent in sporotrichosis). Another side of the treatment to be considered, is the individual intolerance, but this is a personal factor which cannot influence the general rules of treatment.

For the intravenous injection we used an apparatus shown in one of the plates.

In some cases of intravenous injection we noticed that the solutions of sodium, and especially, those of potassium iodide, were very painful and irritating, when, as sometimes happensyin these operations, some drop of the solution casually went in the sheath of the vein or even in the neighbouring tissue. Using chemically pure iodide, we may avoid this inconvenience, partly but not wholly, and therefore we use our apparatus. In isotonic solutions the concentration does not require large quantities of liquid for the injection of large doses of iodide. This apparatus consists of 2 tubes A, and B., both of a capacity of 50 cc. The end of the upper extremities of the tubes is formed by a dilation, full of cottonwool for the filtration of any air we may wish to let penetrate under pressure. The lower part of the two tubes communicates with a single tube of discharge D, provided with rubber tube and needle. At the level of connexion there is a stopcock C which, by its inner orifices, lets D communicate either with A or with B or completely stops the passage of the liquid. Tube A contains the physiological solution, tube B isotonic solution of 8,5 0/00. The needle is washed by a discharge of physiological salt solution. For the construction of this apparatus we are indebted to the obsequiousness of Mr. MANOEL GOMES. The needle is introduced into the vein, after putting D in communication with *A*. We verify carefullv, if the liquid really penetrates into the vessel. Now we effect the communication between D and B, repeating after the injection the washing

with physiological salt solution, by communicating D with A. The needle such being washed of the solution, while still within the vein, we now stop the passage of the liquid and with draw the needle.

The apparatus is fastened to a board, which, in its turn, moves on a board of double size. This changeable height of the apparatus facilatates the quickness of the injection and dispenses with the pear.—

We now wish to express our sincere thanks to Dr. OSWALDO CRUZ for the distinction of publishing this paper in the "Memories" and for his his valuable advise.

We are also indebted to Dr. EZEQUIEL DIAS for his daily aid.

We also wish to thank Prof. Dr. SAMUEL LIBANIO for his sollicitude in putting his ward at our disposal and for his aid in the clinical researches.

We are also indebted to Drs. VIRGILIO MACHADO and MARCELLO LIBANIO, to the former for his clinical observations and to the latter for his masterly propaedeutic advices.

Manguinhos, 23—5—1916.

Plates 4—11:

Photographs.

Nº 1 = Carrot culture (14 days old).
« 2 = Sabouraud culture (1 year old)
« 3 = Sabouraud maltose culture (17 day).
« 4 = Initial form. Ocular for projection. Obj. 1/12 homogeneous immersion.
« 5 = Initial forms. Hanging drop.
« 6 = Initial forms; beginning of the mycelium formation. Hanging drop.
« 7 = Hanging drop. Mixed and oidian form. Ocular for projection. Obj. 1/12 homogeneous immersion.
« 8 = Hanging drop. Ocular 4. Obj. C. 320 days of culture on carrot.
« 9 = Broad mycelium of an old culture.
« 10 = Bacillary forms. Poor medium. Ocul. for proj. Obj. 1/12. Homogeneous imm.
« 11 = Mycelian form (sputum) similar to that of some cultures. Ocul. for projection. Obj. 1/12. Homogeneous immersion.
« 12 = Mycelian form of culture similar to that of the sputum. Ocular. for projection. Obj. 1/12. Homogeneus immersion.
« 13 = Yeast form from sputum (Gram). Ocular for projection. Obj. 1/12. Homogeneous immersion.
« 14 = Section of human lung. 3 foci of parasites. Ocular for projection. Obj. 3 Leitz.
« 15 = Section of human lung. Other aspect. Ocular for projection. Obj. AA. Zeiss.
« 16 = One of the foci in human lung. Forms of fungus similar to those of cultures on poor medium. Ocular for projection. Obj. 1/12. Homogeneous immersion.
« 17 = Other aspect of the foci. Pseudo-mycelian forms similar to those of certain cultures. Ocular for projection. Obj. 1/12. Homogeneous immersion.
« 18 = Cultural forms similar to those of the pulmonary foci. Ocular for projection. Obj. 1/12. Homogeneous immerson.
« 19 = Human lung. Section of alveolus. Fructifying mycelian form. Ocular n. 4. Obj. 1/12. Homogeneous immersion.
« 20 = Human. lung. Other aspect.
« 21 = Positive oidiomycotic intradermoreaction.
« 22 = Other aspect of positive oidiomycotic intradermoreaction.
« 23 = Lymphglands of the mesentery of "*Hapale penicillata*", tumefaction due to O. brasiliense. Disease of two months standing.
Nº 24 = Radiography of human body. Tracheo-bronchial adenopathy caused by O brasiliense.
« 25 = Other aspect of the same lesions.

Plates 12 to 14.

Plate 12.

Fig. 7 = Culture in poor medium.
« 8 = Culture of *Eudomyces ailicans*; same age as 9.
« 9 and 10 = Sabouraud maltose culture (classic formula). Different stages.
« 11 = Potato culture with a velvety and spiky aspect.

Figure 12 = Carrot culture. Same aspect as potato culture.

Plate 13.

« 1 a = Forms of fresh cultures.

« 1 = Cultural forms of the fungus on poor medium.

« 2 = Form of the fungus in the human lung.

« 3 = Pseudomycelian form of human lung.

« 4 = Pseudomycelian form; culture on poor medium.

« 5 = Oidium form (potato-culture).

« 6 = Formation of a mycelium (potato-culture).

« 7 to = Several yeast-forms of multiplication by gemmulation (Potato culture).

« 11 = Double yeast-gegemmulation. Presence of septa (Sabouraud culture).

« 12 = Classical form of blastomyces — Sabouraud culture).

« 13, 14, 16 and 17 = Yeast forms. Period of division. The structure (culture) is seen.

« 15 = Structure of yeast-form (culture).

« 18 to 31 = Abnormal forms of old cultures, similar to those of the serosae.

Figure 32 to 45 = Abnormal forms from serous membrane analogous to those of poor medium.

« 46 = Mycelium similar to that of sputum (culture).

« 47 = Mycelium of sputum, similar to that of some cultures.

« 48 to 50 = Yeast forms with halo. Sputum. Staining with methylene blue. Intra — cellular gloea.

« 51 = Aspect of mycelium in the culture.

« 52 = Mosaic form. Culture of 85 days. Intracellular gloea visible.

« 53 = Terminal chlamydospore.

« 54 = Intracellular chlamydospore.

« 55 = Pseudomycelian form in human lung.

« 56 = Other aspect and other staining of the mosaic-form of human lung.

« 57 to 78 = Exclusive yeast forms (culture).

« 79 80, 81 and 83 = Filamentous and pseudomycelian forms (culture).

Figure 82 = Form similar to that of sputum (50).

« 84 = Septate mycelia in larger pieces (old culture).

« 85 = Irregular mycelium (old culture), pale, homogeneous, almost without septa.

Figure 86 = Other aspect of the mycelium in old culture.

Plate 14.

« 87 = Section of human lung, foci of parasites; hemorrhagical foci.

« 88 = Section of human lung; 2 large foci of parasites.

On Brasilian fresh-water shells of the genus Planorbis

by

DR. ADOLPHO LUTZ

(With plates 15—18).

The fresh-water mollusks are intermediary hosts of the *Trematoda*, to which belong many parasites of importance for man and domestic animals. On account of this fact their study is not merely of malaco-zoological interest, but also belongs to medical zoology, as well as the study of blood-sucking insects.

One of the most important genera of these mollusks is *Planorbis*, because the intermediary hosts of *Schistosomum mansoni* belong to it, as was shown in Egypt by a medical commission, directed by LEIPER, and afterwards confirmed by studies, made by me on brasilian species. In the present paper I shall give the description and determination of the species, used in these studies; they are accompanied by good illustrations and preceeded by some general notions for the use of readers less familiar with the matter. I add a catalogue of other Brasilian and South-American species, as found in litterature, reproducing the descriptions and drawings, so as to help the determination of any species observed.

The fresh-water mollusks may be divided in *Gasteropods* and *Bivalves*. The gasteropods walk on a single foot, provided with a sole; the head shows two or four antennae and the body is elongated. The simplest type is seen in the slugs which have no shell and show bilateral symmetry. Supposing a slug forming a shell, open at the cephalic end and increasing in width while the animal grows, the shell will take the form of a more or less elongated paper cornet. If one side grows more than the other, it will take a form like a ram's horn; the circumvolutions may be twisted round each other in various ways, flattening themselves more or less by contact and so forming the enormous variety of shells, used chiefly for the classification of these animals. If the right side grows less, the shell will turn on this side

and become *dextral*, which is the rule; in the opposite case, it will be *sinistral*. When the shell is altogether elongated, conical, fusiform or globose, the opening in the dextral is opposed to the right hand of the obserserver, when the apex is directed upwards and the mouth forwards. In the sinistral, it takes an opposite position, to the left hand of the observer, and, in this case, not only the direction of the shell, but also the position of the organs of the inhabitant is reversed.

The gasteropods of fresh water are either operculate or not operculate. The first include the largest forms in the genus *Ampullaria*, characterised by four antennae and e respiratory syphon. Their shell is usually globose, as in the common snails. They are generally known by the name of "*aruá*" in Brazil and principally in the north, where they are eaten. The family *Melaniidae* contains other species, abundant in rivers, the shell being thick and calcareous, of elongated conical form, showing longitudinal sculptures and often a corroded apex. They frequently contain trematodes, but none of them is known to be of greater importance. Many *Melaniidae* are viviparous.

The most important species belong to the family *Limnaeidae*, formed by non-operculate fresh-water snails provided with lungs. In their form they are like many terrestrial species, often found near the water, but they are easily distinguished by their way of living; they are always found in the water (or close by, when they exceptionally leave it). Also they never have more than two antennae and the eyes are at their base. With exception of *Ancylus* they have a large respiratory cavity, easily seen through the transparent shell.

For distinguishing our genera, the following key may be used:

1. Shell small, flattened like a shield. ..... *Ancylus*
   Shell with distinct whorls. . 2
2. Shell discoid, twisted like a watch-spring. ..... *Planorbis*
   Shell ovoid or sub-conical. . 3
3. Shell sinistral. Antennae filiform. ..... *Physa*
   Shell dextral. Antennae enlarged at the base. .... *Limnaeus*

The three last genera have sub-genera; if these are given the value of genera the first pass to the rank of super-genera.

Of *Ancylus* I observed a species corresponding probably to *A. moricandi* and a few others.

Of *Limnaeus* I observed a species which may be *viator* of D'ORBIGNY and is probably the intermediary host of *F. hepatica*; there are a few other species rarely found.

Of *Physa* I found two species, one of them common.

Of *Planorbis* four species, found in Rio, and seven more, observed in the North, are discussed in this paper.

While the genus *Planorbis* is easily recognized by the typical shell-form, the determination of the sub-genera and species is often very difficult. The former were mostly established long ago, with an insufficient knowledge of many species. These are distributed all over the world and already in 1850 numbered nearly 120. Considering that the species are often widely spread and rather variable, we might expect a large synonymy. The difficulty in obtaining all the literature, as well as the insufficiency of descriptions, often made from empty shells, form other obstacles.

If the characters, taken from the shell, are not sufficient, as a rule, the other ones, also, are not very satisfactory. The radula or scraper, which covers the tongue, has a very variable structure, used for the classification of families and genera but seemingly less useful for distinguishing sub-genera and species.

Our species may be divided in two groups, of which the first contains species with plenty of black pigment and abundant hemoglobine, dissolved in the blood and colouring it red. Form and size of the shell are variable but the whorls are always rather wide in relation to the diameter of the shell. With the animal inclosed the shell appears

very dark; however, when the mollusk, in consequence of a kind of albinism, shows little pigment, the result is a bright orange or reddish colour, due to the red blood. Our species belong apparently to the subgenera *Menetus* and *Taphius*, the latter forming a transition to the second group.

The second group consists of small flat species of light hue, due to the absence of red colour in the blood and of black pigment in the skin. The whorls are numerous, narrow and more or less flattened. The head, at least in three species, shows a yellow spot; the shell assumes a horizontal position. This group seems to belong to the sub-genus *Spirulina*.

Of the first group I observed about seven and of the second three species, figured at the end of this paper.

The shells of the mollusks generally show three layers, the exterior being formed by the epidermis; the middle one has a calcareous appearance, while the inner consists of mother-of-pearl. In the *Limnaeidae* the layers are not distinct; the fresh shells, formed principally by a corneous substance, the conchiolin, are very thin and transparent. Only in pathological conditions, when the epidermis is destroyed and the media attacked by small algae or other aquatic organisms, or in dead and old shells, the calcareous aspect appears, accompanied by a brittle consistence. The inner layer only shows at the opening of the shell where the last whorl ends in contact with the preceeding one, forming a milky spot.

The colour of the fresh shell is variable in the same species, also the thickness, which seems to depend on external conditions. Some shells are almost hyaline of amber or honey colour, or rusty, or blackish. During life the colour of the animal shines through the transparent shell which, after death, shows a more variable colour, in consequence of decomposition. The form, resulting from the direction of the whorls, is also rather variable; if the specimens are numerous, some aberrations always exist, which, if found alone, might make the determination very difficult.

The colour of the animal may be light, of almost transparent or of opaque, more or less dirty white, or ocraceous. Many species have abundant black pigment which, however, may be much reduced in some individuals. In the larger and darker species the blood is distinctly reddish, on account of the haemoglobin, dissolved in the plasma. Such species, in specimens with much blood and little pigment, may appear reddish-brown, instead of black. In two species we even found individuals almost without black pigment, showing animals of bright orange colour which seemed to belong to another species. Such specimens are very useful for anatomical studies.

Dimensions ought to be taken from the largest specimens, which are comparatively rare, as only a small proportion attains the age limit. (In many mollusks the propagation takes place before full size is attained). In our group adult individuals do not show the thickening of the lip or free edge of the opening, seen in other shells, and so we run the risk of taking for small forms young specimens, belonging to large species. The dilation at the mouth of the shell may be observed, as well in young, as in old specimens of certain species.

Characters are taken from the width or largest diameter of the shell, from the number of whorls and the way in which they cover each other, from the form of the perpendicular section and of the mouth or opening of the last circumvolution. The height at the mouth does not necessarily correspond to the largest diameter of the opening which may be oblique. Even the mouth is not perpendicular to the whorl, but more or less inclined and the last whorl may be deflected, upwards or downwards.

For understanding all these relations, nothing is more useful than a perpendicular section, passing through the center of the shell, opening all the whorls and showing the mouth, like those we give in the drawings of almost all the species. I think that

this new proceeding represents a real progress, as it clearly shows as much in one drawing, as three ordinary drawings, and makes a description unnecessary.

Whether the shell in the genus *Planorbis* be dextral or sinistral or variable, according to species, is a question on which the authors do not agree. This is due to the fact that the apex is not well defined. If we put the mouth in sinistral position, the upper face may be depressed and even distinctly umbilicated, which, to several authors, is a sufficient reason for orienting the shell in the opposite way. At the mouth the under side is longer, which to MOQUIN-TANDON is a sufficient reason for considering it as the upper one. Admitting these objections, I however, attribute such characters to secondary changes and adaptations, while, at least in the species I examined, the animal is sinistral (as in the nearest genus *Physa*); in this case the shell also must be considered sinistral. Drawing the shells in this position, we gain the advantage of exposing the mouth opening.

The animals of most european species of *Planorbis* are well described (for instance in the book of MOQUIN-TANDON), but those of other countries are little known.

In our drawings of various species of *Planorbis* the form and the position of the animals, inside and outside of the shell, is well shown. In walking, the animal rests on the sole of the foot, over the front-parts of which appears the head with two lateral lobes. On the under side the mouth is seen and its working may be appreciated when the animal feeds on the side of a glass jar. On the upper side we find the antennae which may be somewhat retracted, but not invaginated, as the eye-bearing antennae of the terrestrial snails. The eyes are situated inwards of their base, while outside and to the left the head and the male genital duct may be seen. The part behind the head and the foot and supporting both of them, may be called the neck, as it moves and turns with great ease. Behind the neck appears a kind of diaphragm, shutting the shell like a curtain, when the animal partly leaves it. It is the fold of the pallium and its posterior side runs backwards, forming the covering of the visceral cavity and the lining of the shell. The first part of the visceral sack is mostly occupied by the respiratory cavity which occupies the length of at least one whorl. It is, as a rule full of air and communicates with the outside by means of an opening provided with a sphincter, the *foramen respiratorium*. The extension of the cavity shows through the shell by increased transparency, which in smaller forms is almost complete.

The intestine and the genital ducts running along the wall are indicated by a more intense pigmentation. There are also spots, or a continuous layer of pigment situated in the pallium. Behind and near the posterior end of the breathing cavity the beating of the heart, formed by two cavities, may be faintly seen through the shell. Near it is the kidney, showing a glandular aspect, and behind it the large liver with its yellowish or greenish-brown colour. Above and inside its apical portion lies the sexual gland which furnishes the products of both sexes. It is known by its granular or vesicular appearance and well distinguished from the liver by its lighter colouring.

The intestine is divided in pharyngeal bulb (containing the radula), oesophagus, stomach and posterior gut. It extends backwards to the liver where it forms a loop returning forwards. The anus is found near to the opening of the breathing cavity.

I shall now discuss several brasilian species of *Planorbis* which I observed alive, four of them being found near Rio de Janeiro. The drawings given are so accurate that they make the description almost unnecessary. I shall also mention other brasilian and south-american species, reproducing the descriptions and drawings I found in the litterature.

The three first species, given in natural size, are distinguished principally by the shell; the animals of all of them are blackish; the pallium of the respiratory cavity shows velvety

black pigment and the abundant red blood lends its colour to the tissues, principally to these of the visceral sack. The shell is carried more or less perpendicular to the support and has a corneous appearance. In life it is transparent, with ocraceous yellow or reddish-brown tint. In pathological conditions and after death it becomes opaque. All of them have at least five whorls when adult. Young specimens already show differences in the shell, which, however, is less dark, almost vitreous. The tissues also are less pigmented and the tegument of the respiratory cavity is only spotty (fig. 6). The red visceral part and the position of the shell show that they are young forms and not a small species.

The small species in the second plate (magnified) carry the shell generally parallel to the support and the blood is often apparently colourless.

I begin with the largest species, of which there are descriptions and drawings permitting to identify them.

1. Planorbis olivaceus SPIX
(Plate XV, fig. 1, a, b, c, d; XVIII 1, 2).

Syn. *Pl. cummingianus* (?), *Pl. bahiensis* DUNKER.

I give, in plate I, good figures of this species which seems limited to the North of Brazil; it does not occur near Rio de Janeiro which is important, as it is one of the principal intermediate hosts of *Schistosomum mansoni*. It is larger than all the other species. Samples received in large numbers from Aracajú were observed alive during a long period and agreed well with the drawings of SPIX and one of SOWERBY in the *Conchologia* of REEVE, also with one PIRAJÁ gave of *Pl. bahiensis*. The large *Planorbis* of Bahia agree in every detail with those of Aracajú, as I have since observed. Though the drawings mostly represent the shell only, they are sufficient because it is well characterized. The adjective olivaceus does not fit the shell very well, but, combined with brown or black, might refer to the animal which is less black than in the two next species. The two authors, SPIX and WAGNER, consider the shell dextral and [illegible] the following description:

"*Planorbis olivaceus*, Tab. XVIII, Fig. 1.

Pl. testa discoidea, tenui, superne plano depressa, inferne late umbilicata, olivacea, anfractu ultimo compresso.

a. Testa maiore: Pl. olivaceus SPIX, Tab. XVIII fig. 2.

b. Testa minore: Pl. ferrugineus SPIX, Tab. XVIII, fig. 1.

Testa discoidea, tenuis, pellucida, oblique striata superne plano depressa, inferne late umbilicata, epiderme tenuissima vestita. Anfractus quinque plano-convexi; ultimus maximus versus peripheriam compressus; omnes gyri umbilico latissime visibiles. Apertura valvae obliqua; margine acuto. Color epidermis olivaceo-viridis aut olivaceo-lutescens; apertura alba; color testae decorticatae caeruleo-albidus. Longitudo 3 ½ lin., latitudo 1 poll. 2 ½ lin.

Habitat in rivulis silvestribus ad Ilheos et Almada, provincia bahiensi.

Observatio: Differt haec species a planorbi corneo testa humiliore, anfractuque ultimo compresso."

To judge by the figures given, WAGNER was right in considering the specimen, named *ferrugineus* by SPIX, as just a small individual of *olivaceus*. Thus it would be a synonym, as also probably *albescens* and *viridis* which WAGNER considered as young specimens of another species (*Planorbis lugubris* WAGNER), found in the same place.

D'ORBIGNY, who probably never observed the real *olivaceus*, referred to *ferrugineus* a rather common species of Rio de Janeiro where the real *olivaceus* is not found. This same species, which I shall call *confusus*, was figured in the *Conchologia iconica* also, with the ame of *ferrugineus*.

The exact drawings given in plate XV make a detailed description of the shell superfluous. I saw many specimens of the size represented, the largest diameter being 33 to 35 mm., but most of the individuals found are smaller. The height of the whorls, with exception of the last, is rather constant and always small; the last one

shows a greater height, although this is inferior to the width. Considering the shell sinistral, the upper half of the whorl is always narrower than the under one. Generally, the upper face is more concave and the last whorl a little deflected upwards (Pl. XV b), but sometimes the contrary may be seen (Pl. XV e). The opening does not show an angle on top, but in exceptional cases there may be a very narrow curve.

The colour of the shell varies from transparent corneous to light ocraceous in life; after death it may become more or less opaque, whitish or straw-coloured. The part occupied by the animal always appears dark.

The animal itself is dark blackish; when little pigmented and full of blood, it appears reddish-brown; other specimens are dark olive in colour. The part over the respiratory cavity does not show as dark and velvety black as it may do in the two following species. The specimens from the north did well in captivity, but would not breed in the cooler season. They are easily infected with *Schistosomum mansoni* and spontaneous infection is pretty frequent.

Planorbis olivaceus was observed by SPIX in Ilheos and Almada, where we could not obtain it now; also by PIRAJÁ in the city of Bahia where it is quite abundant and the only large species. Other specimens were obtained in Aracajú where they were exceedingly common. It often occurs alone and sometimes with other species. As for the subgenus it agrees with *Menetus* ADAMS, though in size it is larger than the average. *Planorbis bahiensis* DUNKER, a possible synonym, is considered by VON MARTENS as intermediary between *Menetus* and *Helisoma* SWAINSON, 1840.

2. Planorbis confusus n. n.

(Plate 15 fig. 2, a, b, c, d.)

This species was referred to by D'ORBIGNY as *ferrugineus* SPIX, but differs by the shape of the mouth, as described by D'ORBIGNY and figured in REEVE-SOWERBY, where *confusus* appears a second time with the erroneous name *tenagophilus* D'ORBIGNY. (For this and other reasons the name of SPIX cannot be used.) I found it in the same place as D'ORBIGNY. Fortunately it does not seem to exist together with the first species, which would make the determination of not very typical specimens rather difficult. The largest specimens, as shown in the figure, never come up to the size of the preceeding species and the last whorl is genenally bent a little upwards and narrower, but relatively higher, showing, in sinistral position, a rounded keel near the suture. The number of complete whorls does not exceed five, while in the preceding species there may be six. The animal differs little in both species, though that of *confusus* is a little darker.

The shell occurs in ditches and in pools of standing water, with or without aquatic plants, sometimes in very large numbers, of which only a few have reached full size. It is rarely found alone; in Rio it is often accompanied by the next species. The shell is transparent horny-yellow but looking black when filled by the living animal. It is often attacked by small algae, producing excavations, where the shell appears calcareous and white, becoming very weak and brittle. After death, the whole shell may become opaque and calcareous.

In his "Journey in South America" D'ORBIGNY mentions this species and gives the following description:

"Planorbis ferrugineus SPIX.

Planorbis ferrugineus et P. olivaceus SPIX, pl XVIII, fig 2.

1. Planorbis olivaceus WAGNER, id. D'ORBIGNY Syn. Mag. de zool. (1835) pag. 26 no 1.

P. corpore nigrescente. Testâ discoideo-depressâ, subdiaphanâ, ferrugineâ, superne plano-depressâ striatâ subtus concavâ sublaevigatâ, anfractibus sex, subangulato aperturâ semilunari.

Diam. 30 millim. alt. 10 centim.

Cette belle espèce, remarquable par sa partie supérieure peu déprimeé, par sa partie inférieure concave mais étroite comparative-

ment aux autres espèces, habite le Brésil, principalement les environs de Rio de Janeiro. Nous l'avons recueillie dans les marais de S. Christophe où elle est assez rare.

Son animal, blessé rend une liqueur rougeâtre sanguinolente.»

The observations of D'ORBIGNY on the *Planorbis*, referred by him to *ferrugineus* SPIX, can not apply to *olivaceus* SPIX, as the dimensions would suggest. Not only is *olivaceus* never found in Rio (where *Schistosomum* is unknown) but the species still existing in São Christovão is our *confusus* (unable to transmitt the parasite). Its largest specimens, but rarely found in Manguinhos, are very like olivaceus, but do not exceed 25 mm.

3. Planorbis (Menethes) nigricans SPIX 1827.

(Plate 15 fig, 3 a, b, c, d.)

Syn. *lugubris* WAGNER 1827

Tenagophilus D'ORBIGNY, 1847

Biangulatus Spec. 25 of REEVE-SOWERBY.

By the rules of priority SPIX's name seems to take the precedence; according to WAGNER, he gave it to the two larger of four specimens; the two others, called *albicans* and *viridis*, were young and one had lost its epiderm. They were found together with *olivaceus*. WAGNER, despising the name of SPIX, gave another collective name and D'ORBIGNY, much later, still augmented the synonymy, without any necessity, as he must have known the work of SPIX and WAGNER. The last name, *tenagophilus*, is frequently found in litterature. There is not much doubt about the identity; only for the species of other american countries one might desire a more exact comparison.

I give drawings of chosen specimens. As is the rule, the majority of specimens is not of the largest size, with a shell of about 18 mm. in diameter. The height of the whorls, forming the principal feature of the species, is rather variable and may attain about 8 mm. At the same time, the width is reduced becoming much less than the height. In sinistral position, the upper part of the whorls is very prominent and has a rounded keel. Below and outside, the whorls have another, less distinct keel. The horny shell shows a reddish brown colour, more pronounced than in other species, and is, sometimes, somewhat opaque, even in the live animal. The pigmentation of the animal is a little variable, but generally very dark; it becomes velvety black over the respiratory cavity. The species was found by SPIX, together with the first one, in the State of Bahia from where I received typical specimens, collected in Caravellas. D'ORBIGNY found it in the Argentine Republic; it also exists in Uruguay (1) and Paraguay. In Rio it is not rare. I got typical specimens from a ditch in Santa Cruz, where it was the only *Planorbis*. In Manguinhos and other places it is found together with the preceeding species, making the determination of some specimens difficult, because both the species vary and only the typical forms are easily distinguished, while the aberrations are more alike. I give a reproduction of the descriptions of SPIX and WAGNER and D'ORBIGNY.

SPIX et WAGNER, pag. 27.

"Planorbis lugubris WAGN. Tab. XVIII fig. 3, 4, 5, 6.

Pl. testa discoidea, tenui, utrinque profunde umbilicata, ferruginea; anfractibus rotundatis, oblique stratis.

a) Testa adulta maiore.

b) Testa juniore, minore: Planorbis nigricans, albescens et viridis SPIX, Tab. VXIII Fig. 3, 4, 5, 6.

Chemnitz, Conchylienkabinet, Tom. IX, Tab. 127, Fig. 118.

Testa discoidea, tenuis, pellucida, striis obliquis numerosissimis, subtilibus instructa; epidermide tenui vestita. Anfractus quatuor rotundati; ultimus inflatus, cylindricus; caeteri gyri utrinque aream profunde, excavatam formantes, quae tamen in parte inferiore est

1) Specimens of Concordia in Uruguay, though apparently of the same species, have much larger dimensions (22-23 and 8-9 mm.)

profundior quam in superiore. Apertura obliqua, margine acuto. Color epidermidis ferrugineus; color testae epidermide privatae albus.

Long. 3 ½ lin.; lat. 10 ½ lin.

Habitat cum precedente.

Observatio: Figura 3 specimen decorticatum ostendit. Fig. 5 et 6, specimina juniora exhibent. Haec species Planorbi corneo maxime affinis at testa utrinque umbilicata diversa."

D'ORBIGNY, Voyage etc.

"Planorbe ténagophile, Planorbis tenagophilus d'Orb.

Mollusques pl. XLIV, fig. 9-12.

P. corpore nigrescente.

Testâ opacâ, corneâ vel castaneâ, transversim striatâ, superne plano-concavâ, subcarinatâ, subtus concavâ, carinatâ, sutura angulosâ, profundâ; aperturâ obliquâ semilunari. Diam. 16 millim.; alt. 8 millim.

Nous devons supposer qu'elle habite toutes les plaines de l'Amérique méridionale depuis Corrientes jusqu'en Bolivia. Dans ce dernier lieu, elle est toujours plus petite, tandis qu'à Santa Cruz elle est souvent beaucoup plus déprimeé".

4. Planorbis guadaloupensis SOWERBY.

(Plate 17, fig. 7. a, b, c, d.)

This species was taken among aquatic plants in the Lagoa de Estremoz near Natal, where it was rather scarce. I also received living specimens from Maranhão, sent by Mr. FABRICIO CALDAS DE OLIVEIRA. BAKER had already found empty shells in the lakes of Estremoz and Papary. It seems frequent in Venezuela, where it was determined by V. MARTENS (1) and figured in a paper of ITURBE and GONÇALES, who consider it as the principal intermediary host of *Schistosomum mansoni*. In the Antilles it seems to exist not only at Guadaloupe from where it took its name, but also in other islands, as for instance Portorico.

Our specimens agree perfectly with the drawing of SOWERBY and the phototypy of the venezuelian authors. With a width of about 18 mm. (2) and a height of about 5 mm., it is much larger tham *centimetralis*, but much smaller than *olivaceus*. It has 5 ½ high and rather narrow whorls, kidney-shaped in section and with somewhat blunt superior keel. The shell is generally clean and polished, very transparent but somewhat yellowish; it contains a very black animal with plenty of red blood; it has a great attraction for the miracidia of *Schistosomum* and is easily infected by the antennae, as verified by me in specimens from Maranhão.

In REEVE-SOWERBY, Monograph of the Genus *Planorbis* the following description is found:

"PLANORBIS GUADALOUPENSIS. Testâ sinistrali, compressâ, latâ, fulvâ, politâ; spirâ concavâ, anfractibus senis, convexiusculis; ultimo anfractu magno, supra suturam elevatâ, tum declivi, infra latiusculâ; disco inferiori convexo, aperturâ subtriagonâ inferiori ad anfractum productâ.

SOWERBY, Genera of Recent and Fossil Shells.

Hab. Guadaloupe."

5. Planorbis centimetralis n. sp.

(Plate XVII fig. 8, a, b, c, d.)

In the State of Pernambuco, one of the principal centres of intestinal schistosomatosis, the largest species of *Planorbis* are unknown, but a smaller one is widely spread, as well in rivers as in ponds. Trying to determine it, I found considerable difficulty. It looks somewhat like *peregrinus* D'ORB. of which F. BAKER mentions a specimen from Ceará which may belong to our species; the true *peregrinus*, however, which I obtained in Montevideo, is larger and differs by the form of the last whorl. BAKER also mentions *stramineus* DUNKER as a species of Ceará, but its size and form do not agree, if the drawing of REEVE-SOWERBY be correct.

1) This author cites also Nova Granada, Cayenne and Surinam.

2) Von Martens mentions specimens of 24 mm. (Venezuela and Surinam).

Without denying that this species may have been collected before, I do not think that it has been well defined, which obliges me to give it a name. I call it *centimetralis* to indicate the size which, in this case, helps very much to recognize it.

The shell of *centimetralis* has only four complete whorls, or 4 ½, if the hollow centre is reckoned as half a whorl. Their calibre increases rapidly and the end of the last whorl is bent (see Plate XVII) upwards and dilated at the mouth. Form and direction of the whorls, (fig. 8 b,) are somewhat variable; both surfaces are umbilicated, the upper one being more excavated than the under one, which may be flat outside the navel. The shell shows fine spiral striaton and an ocraceus or, more commonly, rusty brown colour, being usually covered with opaque scars and often with algae and other organisms, which may form larger crusts.

The animal is black, but the pigment, although generally abundant, is absent in some animals, which show a ferrugineus or orange colour, partly due to a large quantity of red blood.

This species is found in smaller and larger brooks, which may even have a swift current; but then it seeks the muddy river-side where the water is more quiet. It feeds mainly on this mud and does not seem to do well in quite limpid water.

The specimens found in ponds often seem smaller and thicker and altogether a little different, but the dimensions are approximate and, there are intermediary forms which do not allow the distinction of two species.

The largest diameter of the shell is about 1 cm., varying 1 mm., to more or less (1).

Centimetralis seems wanting in the Capital of Pernambuco and in the river Beberibe, but occurs already in Socorro and Jaboatão. It is common in the rivers Capibaribe, Ipojuca, Una and their affluents, as well as in independent water-collections of the same regions. It occurs also in Alagoas and even to the south of the river S. Francisco. More to the south I found only a few specimens in a brook near Retiro, a railway-station near Juiz de Fora. In Paraguay I found a species very much like it, if not the same. To the North of Pernambuco it occurs in several natural ponds, but is wanting in a larger number. I obtained specimens in Independencia and in the city of Parahyba, also from the lake of Estremoz and a large pool in Ceará-Mirim (Rio Grande do Norte). I also received specimens from Ceará and Maranhão.

6. Planorbis (Taphius) nigrilabris.

(Plate XVI, Fig. 6 a, c, d.)

This is a small species, apparently not described, which I know only from one place near Rio de Janeiro. This is a pool full of dead leaves and branches and subject to drying up, near kilometer 22 of the Leopoldina Railway, where it coexists with *Planorbis melleus* mihi. By its very characteristic aspect it seems to belong to the subgenus *Taphius*.

There are four complete whorls, not counting the hollow central part, or 4 ½ with it. They have a sub-reniform section, increasing rapidly in height and width. The last one is somewhat dilated at the mouth and deflected, in variable degree (upwards if the shell be considered sinistral). The opening becomes almost horizontal; it is largely piriform, attaining 2 ½ mm. in the largest diameter which is oblique. The height of this whorl is not more than 1 mm. The largest diameter of the shell exceptionaly attains 6 mm., being generally only 5 and 5 ½.

The shell is almost equally excavated on both sides or a little flatter on the under side. It is ambercoloured or, but rarely, rusty, with fine oblique striae. In mature specimens the rim of the mouth is somewhat thickened, showing mostly a black border. The animal is black and through the transparent shell it shows irregular spots of black pig-

1) The dimensions given by V. MARTENS for *stramineus* agree with our species but not with the original description.

ment over the breathing cavity. The visceral part, while in the shell, appears rusty brown.

The eves are middle-sized and the antennae rather long and pointed. The foot is short and the shell is carried parallel to the surface on which the animal walks. I refer the reader to the drawings distinctly showing the peculiar characters.

The same species was found in Bahia (Lagoa da Amaralinha) and in the city of Natal. Specimens of Planorbis from the city of Parahyba (Lagoa de Baixo) appear somewhat larger and a little different; they belong to the following closely related species.

7 Planorbis melleus LUTZ
(Plate XVI Fig 5 a, b c, d).

This little species of the sub-genus *Spirulina* does not agree with any found in REEVE-SOWERBY, nor with other descriptions in the literature known to me. Fom *Pl. heloicus* D'ORBIGNY, it is easily distinguished by the colour of the animal, and from *Segmentina janeirensis* CLESSIN by the absence of the characters of this genus.

Pl. melleus has 5 complete whorls, or 5 ½ with the hollow central part. Their section is asymmetrical, sub-reniform, without a keel, with acute internal angles only. In sinistral position the whorls have the upper part wider and the upper face of the shell more excavated. The calibre of the whorls increases very slowly. The mouth is oblique, somewhat sinuous and, sometimes, a little dilated but never thickened. Its largest diameter is oblique, about 2 mm, long; the last whorl has only 1 mm. in height; the largest diameter of the shell is 5 to 5 ½ mm.

The shell is amber or honey coloured; in life the largest specimens appear ferruginous in the part occupied by the animal, which has long antennae. The foot is long and the lanceolate sole ends in an acute point, while the cephalic lobes are angular. The general colour is ocraceous-white with black markings and an orange-yellow stripe between the eyes, which are very large and rimmed with white principally on the outside. The animal is very lively and graceful. It likes to stretch the fore part very much out of the shell, which is carried horizontally.

In Rio de Janeiro I found this species in pools in Manguinhos and Meyer, also at kilometer 22 of the Leopoldina Railway, in a dirty pool without water-plants. In Meyer it was found between green algae in a pool formed by inundation. The species was also discovered in Aracajú and near the salt-works of Parahyba. This snail may resist some time to drought by burrowing in the mud. It is not very rare but easily escapes detection owing to its small size and its tendency to hide.

8- Planorbis (Taphius) incertus n. sp.
(Plate XVII, Fig. 9, a, b, c, 10 d).

I was unable to identify this small species, found by me in the Capital of Parahyba (Lagoa de Baixo) and in Limoeiro, state of Pernambuco (Lagoa da Estação). Its greatest width is abont 6, its greatest height abou 1 ½ m m. It has four whorls or 4 ½ with the hollow central part. The last whorl is deflected, the mouth looking upwards but not as much as in *nigrilabris*. As shown in fig. 9 a, the mouth is more angular and the lip thinner. No black rim was noticed.

The shell is transparent, corneous yellow, somewhat opaque and whitish. There are spots of black pigment seen in the extent of about one circumvolution, and situated in the pallium of the respiratory cavity.

9. Planorbis cimex MORICAND 1837
(Plate XVIII, fig. 14 a, b).

Original description:

"P. testa depressissima, utrinque leviter concava, 6—volva, ultimo anfractu subtus plano, supra semirotundato.

Hab. les eaux douces aux environs de Bahia.

Ce petit planorbe n'a que six millimètres de diamètre, et un millimètre d'épaisseur. Les tours, au nombre de six, sont trés serrés, plats en-dessous et convexes en dessus, sans carène saillante; mais le dernier tour parait caréné, la moitié inférieure étant plate et la supérieure bombée; elles forment na-

turellement un angle à leur jonction. Sa couleur est cornée claire. Les tours s'enroulant dans un même plan, le centre de la spire est légèrement et également enfoncé dessus et dessous."

The author of the name received the species from Bahia. BAKER observed it in the lake Papary and we found it in the city of Parahyba (Lagoa de Baixo), principally on the roots of *Pistia stratiotes*.

The animal is very much like that of *melleus* LUTZ, showing the same yellow stripe on the head, while the black pigment of the whole skin and the red one of the blood are equally wanting. The colour of the body is opaque, ocraceous-white, like in many species of *Helix*, with the inner parts almost transparent; the very thin shell is almost hyaline, only shightly yellowish.

Planorbis cimex, *melleus* and *cultratus* seem to belong to the genus *Spirulina* together with *depressissimus* and a few other small and flat species. In those I found no parasites, nor do they seem to be concerned in the transmission of *Schistosomum*.

10. Planorbis cultratus D'ORBIGNY

(Plate XVIII fig, 10 a, b, c, d).

This species was described first from Cuba but it occurs also in Martinique and on the american continent. A species, thus determined by VON MARTENS, does not seem to be rare in Venezuela. BAKER found six specimens in the lake of Papary near Natal and considered this as the most southern habitat observed. VON MARTENS, however, mentioned it as living in Paraguay, where I have since found it too.) I collected many specimens in Lagoa de Carro and some in Limoeiro and in Victoria, in the State of Pernambuco, while Dr. PENNA found it in Pau d'Alho. It is easily recognised by its marked characteristics, which place it in the sub-genus *Spirulina* together with *cimex* and *melleus*.

Original description of D'ORBIGNY:

"*Planorbis cultratus* D'ORB., Planorbe tranchant Tab. XIV, fig. 5, 8.

Planorbis testâ discoideâ, depressissimâ, tenui, diaphanâ, laevigatâ, succineâ, superne concavâ, subtus complanatâ, ad peripheriam carinato-cultratâ, marginatâ, anfractibus sex angulatis, supra convexis, subtus complanatis, aperturâ triangulari depressâ.

Dimensions, Diamètre. ..... 9 millim
Hauteur. ..... 1 millim

Coquille discoidale très déprimeé, mince, fragile, transparente, légèrement concave en dessus, horizontale en dessous, dont le pourtour est fortement caréné, tranchant et marqué d'une bordure linéaire. *Spire* composée de 6 tours anguleux, convexes et séparés par des sutures marquées en dessus, aplaties en dessous.

Bouche triangulaire, étroite, transversalement déprimée; son angle est aigu et évidé en dessus.

Couleur. Succinée ou verdâtre.

Autant et plus déprimée que le P. compressus, cette espèce est bien plus triangulaire, plus carénée et á tours de spire plus larges. Parmi les espèces américaines, notre Planorbis kermatoides est le seul qu'on puisse lui comparer; néanmoins le P. cultratus s'en distingue par sa plus grande dépression, par sa carène tranchante et bordée.

Nous en devons la connaissance à M. de Candé, mais nous ne la plaçons qu'avec doute parmi les espèces de Cuba, craignant qu'elle ne soit de la Martinique plutôt que de l'île espagnole".

(Histoire physique, politique et naturelle de l'Ile de Cuba par M. Ramon de la Sagra. Mollusques par Alcide d'Orbigny, I, p. 196, 1835).

In Lagoa de Carro I found *cultratus* sticking to a drifting piece of wood or floating horizontally on the surface of a large excavation, which had been made in a brick-factory and was filled with dirty water without any plants; in other places on *Pistia stratiotes* and *Polygonum hydropiper*. The animal has the same colour and the same orange-yellow stripe as *melleus* and *cultratus*. The shell is also carried horizontally.

11. Planorbis (Spirulina) nigellus n. sp.

Colour of the shell the same as in *melleus* but appearing black where the living animal

is seen through it. Whorls semilunar in section, a little narrower above, each whorl extensively covered by the next, which makes the counting difficult. The number in the largest specimens is 5 or 5 1/2 the breadth little more than 4, the height little more than 1 1/2 mm.

The whorls show a sculpture consisting of longitudinal lines of very small, round or more or less elongated beads, in varying number. On the upper side of the shell they are more numerous and distinct. Of other species only *melleus* shows signs of a corresponding, though somewhat different and less distinct, sculpture. The mouth of the shell may be somewhat expanded and show a subterminal black ring.

The animal comes near to that of *Pl. melleus* but is darker. It also has a yellow frontal stripe but the head seems shorter with more rounded mouth lobules. The foot too is shorter and less pointed. The eyes also are large but less distinctly white rimmed. The dark axial thread of the antennae is more distinct and the back of the foot covered with black points, while, the pallium shows inside the shell, a uniform black colour, varying from 2 to 4 mm.

Some twenty specimens were found in the middle of June near Manguinhos in a pool, covered with *Lemna* and *Azolla*. The species which has habits similar to those of *melleus mihi* does not agree with any of the described species. Though this paper was practically printed, I was still able to include the description here.

12. Planorbis (Spirulina) depressissimus MORICAND

(Plate XVIII fig. 15 a, b).

This species may be recognised by the drawing; it was described by the author of the name from specimens sent from Bahia. BAKER quotes an observation from the coast of Ceará, but a specimen sent me as *depressissimus* by FRANCISCO DA ROCHA belongs *to cimex*. Personally I have not seen this species, which seems rather rare.

13. Segmentina paparyensis n. sp.

(Plate XVIII, fig 20 a, b).

Original description by F. BAKER.

"Shell dextral, broadly, rather deeply umbilicate, rather solid, planorboid, everywhere sculptured with minute, retractive, sharp costulae, irregularly sized and spaced, the interspaces being broader, and showing under a strong glass, minute spiral striations on the base; they are formed by the crinkling of the radiating costulae; light horn coloured. Whorls 4, regularly increasing, the last subangulate below the periphery, behind the outer lip for about 1/3 turn, scarcely angulate below, descending very sharply at the mouth: apex depressed, only the last two whorls reaching the upper level of the shell. Aperture very oblique, subhorizontal, rounded; lip simple, not thickened nor sharpened, slightly reflected at the lower angle, extremities approaching, and joined by a slight callus in some specimens; aperture lamellae five, two parietal and three (palatal) on the outer wall; upper parietal lamella about central, the lower about midway between this and the columellar junction and appearing about half the size to external inspection, both showing a nearly triangular section, the lower sides being nearly horizontal, the upper ascending; lower palatal lamella beginning near the suture and extending nearly transversally across the base, and slightly up the outer side, straight and rather evenly arched; remaining palatal lamellae deep within the shell, nearly horizontal, short, the lower one slightly larger.

Greatest diam. 6, least diam. 5,25, alt. 2 mm.

Two specimens were taken near the mouth of the main affluent of Papary Lake. It differs fron *S. janeirensis* Clessin by the unusually deep descent of the last whorl at the aperture".

Neither in Rio, nor in the north of Brazil did I observe any species of Segmentina.

14. Planorbis (Gyraulus) anatinus D'ORB.

(Plate XVIII, Fig. 13 a, b).

According to BAKER, this species described from the river Paraná, occurs in an

artificial lake in the city of Pará. Description and figure are reproduced in the appendix and on Plate XVIII (Fig. 13 a, b.)

Besides the species I mentioned, a few more might be found in Brazil; but the number of good species is small, and may not much exceed 15, which represents about the number of known species. In order to help the determination of such species and other new ones which might appear, I give a reproduction made of all the available drawings, published up to now, of south-american species, and a copy of the descriptions. In the Iconographia of REEVE-SOWERBY, there are many coloured figures of new or already described species, but the latter do not seem to be always well determined. The drawings are not very accurate and the colouring does not help, as it is not very natural. Only new species or those the original drawing of which was wanting, are reproduced, using a technique for the drawings which allowed to compare all the species. This work was done very carefully by a clever artist. I could not obtain all the litterature and so a few species may be missed. I also advise comparing the central-american species of which several appear in South America. The distribution of fresh-water shells is altogether rather curious and not always in relation with that of terrestrian animals.

In the "Proceedings of the Academy of natural Sciences of Philadelphia", December 1913, FRED BAKER published a paper on the land and fresh-water mollusks of the Stanford Expedition to Brazil. In this he enumerates the following species:

Planorbis anatinus ORBIGNY—25 specimens in a natural lake in Belém do Pará.

Pl. cultratus d'ORBIGNY—Lagoa de Papary near Natal, 6 spec.

Pl. cimex MORICAND—13 spec. with Pl. cultratus.

Pl. guadaloupensis SOWERBY—Common near the lake of Papary with *cimex* and *cultratus*. Dead specimens were not rare on the margins of lake Estremoz.

Pl. stramineus DUNKER—Lake Papary with the preceding species.

Pl. depressissimus MORICAND and *peregrinus* d'ORBIGNY—One specimen of each from the coast of Ceará, sent by Sr. ROCHA.

Segmentina paparyensis n. sp.—2 spec. from lake Papary.

Planorbis anatinus d'ORBIGNY—25 specimens in an artificial lake in Belem, Pará.

Pl. cultratus d'ORBIGNY—Lago de Papary near Natal, 6 specimens.

Pl. cimex MORICAND—13 specimens together with the preceeding one.

Pl. guadaloupensis SOWERBY—Common near the Lagoa de Papary, together with the two preceeding ones. Dead specimens were not rare at the border of Lagoa de Estremoz.

Pl. stramineus DUNKER—Lagoa de Papary with the preceeding. Ceará—Mirim and Ceará.

Pl. depressissimus MORICAND and *Pl. peregrinus* d'ORBIGNY 1)—one specimen of each species, from the coast of Ceará, received from ROCHA.

Segmentina paparyensis, n. sp.—2 Specimens from Lagoa de Papary.

List of south american species of Planorbis, mentioned in the litterature.

(Fig. on Plate 18).

albicans Pfeiffer. Hab. Lima (Mus. Brit.) REEVE. Spec. 117, F. 18. a, b. (Cop).

anatinus D'ORB. Rio Paraná—D'ORB. p. 351 pl. XIV, fig. 17—20 F. 13 a, b. (Cop.)

andecolus D'ORB. Lake Titicaca F. 5, cop. from the orig. f. 6 REEVE.

biangulatus SOW. (?=*nigricans* Brazil.)

1) Probably my *centimetralis*.

cimex MOR. Fig. 14, a, b, (Cop) Bahia (MORICAND), Pará (F. BAKER), Rio de Janeiro, (LUTZ.)

confusus n. n. Rio de Janeiro (D'ORB., LUTZ)

cultratus D'ORB. Descr. from the Antilles. (Acc. to F. BAKER in the lake Papary, Rio Grande do Norte.)

depressissimus MOR. – Bahia, F. 15 a, b. (Cop).

ferrugineus SPIX=*olivaceus* SPIX (F. 1, cop), *ferrugineus* D'ORB.=confusus n.n.).

heloicus D'ORB. Montevideo, F. 11 a, b, cop.) hardly larger than cimex MOR., the name of which is anterior.

helophilus D'ORB. Calláo Peru F, 12 a, b. (cop.) In the Museu Paulista there exists an apparently identical species from Itatiba.

kermatoides D'ORB. Calláo, Peru. F. 9, a, b. (Cop).

(*lugubris* WAGNER=*nigricans* SPIX)

montanus D'ORB. Lake Titicaca. – Fig. 6 (cop.)

nigricans SPIX=*lugubris* WAGN.=*tenagophilus* D'ORB). (Cop. fig. 3, 4). Ilheos and Almada, Bahia.

olivaceus SPIX (*cummingianus* and *bahianus* DUNKER (Fig. 2. Cop).

pedrinus MILLER. Ecuador F. 19 (cop. from KOBELT). (perhaps a new form of the species called *peregrinus* by D'ORB).

peregrinus D'ORB. Uruguay, Argentine, Ecuador? (F. BAKER places specimens from Rio Grande do Norte and from Ceará here.) Fig. 8 a, b (cop).

peruvianus BROD. Perú. BRODERICK and D'ORBIGNY (Fig. 16 cop. from REEVE).

pronus VON MARTENS. Lake Valentia, Venezuela.

stramineus PFEIFFER (cop. from. REEVE Hab? (F. BAKER places here a specimen form the coast of Ceará).

tenagophilus D'ORB. (cop. in the fig. 7, a, b).=*nigricans* WAGNER, Argentina and Bolivia (BRAZIL).

Of the sub-genus *Segmentina,* on the mouth of which there are elevations simulating teeth, there is a species *janeirensis* CLESSIN, and F. BAKER describes another one, *paparyensis* which he considers new and which was found in the lake Papary in Rio Grande do Norte (Fig. 20 a, b, cop.).

Appendix.

Copies of descriptions by different authors.

1. Planorbis peruvianus D'ORB.

(Proc. zool. soc. 1882, p. 125.)

P. testâ discoideâ, pellucidâ, globulosâ albidâ, striatâ, superne concavâ, infundibuliformi, subtus planâ; anfractibus quinque, convexis, ultimo subdepresso; suturâ profundâ; aperturâ obliquâ, subdilatâ. Diam. 10, alt. 8 millim.

Hab. Trujillo (BRODERICK) e Callao (D'ORBIGNY), Perú.

2. Planorbis montanus D'ORB.

P. testâ discoideâ, pellucidâ, diaphanâ, subdepressâ, albidâ, substriatâ, superne subplanâ, subtus concavâ; anfractibus quatuor subconvexis: suturâ profundâ, aperturâ obliquâ; sub-pentagonâ. Diam. 16, alt. 6 millim.

Hab. Lago Titicaca, Bolivia.

3. Planorbis andecolus D'ORB.

P. corpore brunneo-rubescente.

Testâ elevatâ, subcrassâ, minutissime striatâ, griseo-brunnescente, superne planoconvexâ, subcarinatâ, subtus maxime umbilicatâ, carinatâ, infundibuliformi, anfractibus tribus subconvexis: suturâ profundâ; aperturâ magnâ, subdilatatâ, pentagona. Diam. 13, alt. 8 millim.

Hab. Lago Titicaca.

4. Planorbis peregrinus D'ORB.

P. corpore caeruleo-nigrescente.

Testâ depressâ, tenui, exilissimè striatâ, corneo-viridescente vel albidâ, supernè planâ, subtùs concavâ, latè umbilicatâ. anfractibus quinque convexis; suturâ profundâ, aperturâ subrotundâ, obliquâ. Diam. 13, alt. 4 millim.

Hab. Argentine, Bolivia and Ecuador, presenting local variations. It lives in large families specially in rivulets.

5. Planorbis heloicus D'ORB.

P. testâ discoideâ, depressâ, tenui, sublaevigatâ, corneâ, supernè subtùsque planoconcavâ; anfractibus quinque rotundis, subconvexis; suturâ profundâ: aperturâ rotundâ obliquâ. Diam. 8, alt. 1 1/2 millim.

Hab. Montevideo.

6. Planorbis helophilus D'ORB.

P. testâ depressâ, crassâ, laevigatâ, albidâ, supernè subtùsque concavâ; anfractibus tribus rotundis, convexis; suturâ profundâ; aperturâ gibbâ. obliquâ; labro crasso. Diam. 5, alt. 1 1/2 millim.

Hab. Callao, Peru. The same (?) in the "Museu Paulista" labelled "Itatiba".

7. Planorbis kermatoides D'ORBIGNY.

P. corpore coeruleo, nigrescente.

Testâ discoideâ, depressissimâ, tenui, laevigatâ, corneâ, supernè plano-convexâ, subtùs plano-concavâ, ad periphaeriam carinatâ; anfractibus sex, subplanis; aperturâ angulatâ, compressâ, obliquâ. Diam. 13, alt. 1 3/4 millim.

Hab. Callao, Peru.

8. Planorbis paropseides D'ORBIGNY.

P. corpore nigrescente.

Testâ discoideâ, depressâ, tenui, sublaevigatâ, corneâ, supernè plano-concavâ, subtùs planâ, ad periphaeriam subcarinatâ; anfractibus quinque, subconvexis; aperturâ subangulatâ. Diam. 6, alt. 1 millim.

Callao, Peru.

9. Planorbis anatinus D'ORBIGNY.

P. testâ discoideâ, globuloso-compressâ. tenui, laevigatâ, lucidâ, corneâ, supernè subtùsque convexâ, centro solum concavâ, umbilicatâ, ad periphaeriam rotundâ; anfractibus tribus, spiris cunctis amplexantibus; aperturâ compressissimâ, arcuatâ, semilunari. Diam. 2, alt. 1 millim.

Hab. Bajada, Entre-Rios.

(According to BAKER, this species was also found in Pará by the "STANFORD expedition".)

10. Planorbis limayana LESSON.

Voyage (de la Coquille) autour du monde T. 2, p. 330. Paris 1830.

Ce petit planorbe est commun dans les ruisseaux... entre Callao e Lima, au Pérou. L'animal a les tentacules longs et d'un beau noir, ainsi que ses autres parties. Son test a au plus 4 lignes de diamètre. Il est parfaitement plane, discoide, à cinq enroulements très-réguliers, à enfoncement ombilical, soit dessus, soit dessous, peu marqué. Les tours sont cylindriques, lisses et à peu près égaux, excepté l'externe qui est légèrement plus gros que les autres. Sa couleur est d'un fauve uniforme.

11. Planorbis depressissimus MORICAND.

P. testa depressissima, subtus plana, supra leviter concava, 5—volva, ultimo anfractu in medio acute carinato.

Hab. les eaux douces aux environs de Bahia.

12. Pl. cummingianus DUNKER.

Pl. testa magna, discoidea, crassiuscula, supra cornea, subrufa, infra olivacea, nitida, obsoletissime striata, fere glabrata, utrinque concava; anfractibus senis ovatis, sutura profunda divisis; apertura obliqua, ovato-sublunata.

Planorbi olivaceo simillimus, sed colore, testa crassiore, splendidiore, fere glabrata,

umbilico latiore, anfractibus convexioribus minus involutis aliisque notis bene distinguendus.

Patria ignota.

13. Pl. stramineus DUNKER.

Pl. tenuistriata, nitida, parum diaphana, straminea, subcornea, supra plano-concava, medio impressa, infra umbilicata; anfractibus quatuor subrotundis; apertura dilatata, fere rotunda. Diam. maximus 6'' fere, alt. 2''. Patria America australis. – Cumming.

E. VON MARTENS, Die Binnenmollusken Venezuela's – p. 198.

14. Planorbis pronus, n. sp.

Testa subinflata, solidula, striata, lineis spiralibus impressis nonnullis exarata, supra profunde umbilicata, infra mediocriter excavata, anfr. 3 ½, rapide crescentes, rotundati, sutura profunda discreti, ultimus infra inflatus ad excavationem basalem subangulatus, *prope aperturam valde descendens;* apertura diagonalis, subtriangularis, margine supero subhorizontali, leviter carenato, margine infero stricto, recedenti, columellari perpendiculari, subdilatato, paries aperturalis callo albido tectus.

Diam. maj. 10, mim. 8, alt. 5, apert. alt. obliq. 5 ½, diam. 4 millim.

Valenciasee.

E. V. MARTENS, loco cit.

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'norbis oli-

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VON MARTENS, E, Die Binnenmollusken Venezuelas.

I have not been able to consult the last paper but, thanks to Prof. CARLOS BRUCH in La Plata, I obtained a copy of the parts refering to Pl. guadaloupensis, cultratus and pronus.

Studies on Schistosomatosis, made in the North of Brazil, by a commission from the Instituto Oswaldo Cruz.

Report and travelling notes presented

by

DRS. ADOLPHO LUTZ & OSWINO PENNA.

Programme of the Expedition.

The Commission designed by Dr. CARLOS CHAGAS, Director of the Institute, to study schistosomatosis in its Brazilian foci (all situated in the North), consisted of Drs. ADOLPHO LUTZ and OSWINO PENNA, each one accompanied by a servant.

Our scope being the gathering of information on the prevalence of *Schistosomum mansoni* and the study of local conditions in the foci of infection, we decided to visit the schools of "Aprendizes Marinheiros" in the North which had already furnished observations to Dr. PENNA and material for studies to Dr. LUTZ. With the indications obtained by examining all the apprentices we would determine the foci in the interior. At the same time many other people, in health or diseased, were to be examined, using every occasion to obtain an estimate of the percentage of infection and the symptoms produced. In the foci of infection the mollusks harbouring the parasite would be searched for, and the species and the proportion of natural infection determined. The *cercariae* obtained would be used for animal experiments.

While pursuing the principal object of the journey, all opportunities for other studies of local pathology and, specially, of parasitical diseases and medical zoology were to be seized.

This programme was calculated for an absence of at least two months. We intended to travel by sea to Recife and from there by railway to Rio Grande do Norte, the most distant of the states we expected to visit.

The return journey, always from North to South, would take us through the States of Parahyba, Pernambuco, Alagoas and Sergipe, ending in the Capital of Bahia from where, after finishing our studies, we would return to Rio de Janeiro by sea.

This programme was entirely carried out without serious difficulties. Our intention however of doing much work in little time, being in opposition to the general habits, was not favoured by the conditions we found,

though everywhere the authorities and also a large number of colleagues gave us their help. If we required nearly three months for this expedition it must be taken into account that we covered much ground (3.000 to 4.000 kilometers), while nearly one month was absorbed by the necessary journeys, not counting a large number of local excursions.

Diary.

[1917]

Follows an extract from the diary of Dr. LUTZ:

"We left Rio in the small steamer "Itapacy" at 4 p. m. of August 3d, with a rather rough sea. On 5 VIII at 7 h. a. m. we entered the port of Victoria, where we went on shore for an excursion. On the rocks we found numerous *Bromeliaceae* containing a rich fauna and, on shore, several interesting plants. Here already there appeared a *Montrichardia*, large araceous plant, common in the swamps of the North.

On 6 VIII we passed the Abrolhos reefs.

7 VIII. We arrived in Ilheos, where the superintendent of the Railway accompanied us on a motor excursion along the railway line to kilometer 20. 8 VIII. We made another excursion to the lake of Almada. On these excursions we collected some interesting mollusks, but failed to find *Planorbis olivaceus*, described by SPIX from Ilheos and Almada, nor could we obtain reliable information as to its existence. Later researches, made by Mr. ZEHNTNER, also failed to give results, showing that in the last century this conspicuous species either disappeared or at least became very rare.

The fact is very important, because it refers to the largest species capable of transmitting Schistosomatosis. No other *Planorbis* was found, but the landscape and the flora offered much interest. Our steamer left at 6 p. m.

9. VIII. In Bahia we stayed only four hours, and visited some colleagues. Afterwards we made an excursion to the "dique", a large pond formed by an old dam, where there are plenty of *Montrichardia*. We collected numerous specimens of *Planorbis olivaceus* and received some more from Dr. OCTAVIO TORRES, but none of them were infected by *Schistosomum mansoni*, though they contained some other trematodes. The snails were mostly adult, 30 mm. of diameter, which points to an age of at least 2 years.

10 VIII. In the afternoon we arrived in Aracajú, where the Itapacy stayed till 11 a. m. of the following day. During this time we visited the school of marine apprentices and made the necessary arrangements for staying on our return. We collected a large number of *Planorbis olivaceus* but failed to find infected specimens.

11 VIII. We spent the night near to the mouth of the São Francisco river, up which we ran the next day, stopping at the "Ilha das Gallinhas". We found the river and its banks prettier than they are higher up, near Joazeiro. On an excursion by canoe, we visited two islands with an interesting flora and observed flocks of a species of goat-sucker. There were no fresh water mollusks.

12 VIII. Towards the evening we passed the dangerous bar of the São Francisco river again; the surf offered a beautiful sight.

13 VIII. We arrived in Maceió and went to Bebedouro, where we failed to find *Planorbis olivaceus*, which apparently does not exist in these parts. In the house of Dr. LUIZ VASCONCELLOS we saw several chickens suffering from an infectious disease, with leucocytosis but apparently without spirillae. Perhaps it might be acute leucemia. We visited the hospital at Maceió and saw a patient whose bloody and mucous dejections contained a large number of eggs of *Schistosomum mansoni*.

14 VIII. We arrived early in Recife and were met by the chief of the school of marine apprentices; here we established a laboratory. Afterwards we visited the governor, the prefect and the director of the sanitary service; all of them received us very well and helped us to arrange the necessary ex-

cursions. We stayed at a boarding house in the rua Conde Bomfim.

15 VIII. Using the Prefect's motor-car, we visited the slaughter-house where we gathered information about parasites and diseases of cattle. We obtained none concerning Trematodes, nor did our examinations give any result. A bullock come from the direction of Bahia, was said to suffer from "mal triste". After being killed, it showed countless hemorrhages in the intestine, gall-bladder and mesentery, also hemorrhagic nephritis, but the spleen was small. Macroscopical and cultural examination showed *Bacillus anthracis*. We also worked in the laboratory. Examination of numerous *Planorbis* from Bahia and Aracajú failed to reveal any *cercariae*.

16 VIII We visited the Hospital D. Pedro II, where we saw many patients, suspected of schistosomatosis or suffering from malaria, anemia, tuberculosis, heart disease etc. and left many small tin boxes for samples of feces. Afterwards we went to the isolating hospital and saw a few cases of bubonic pest and some other patients, from whom we ordered samples for examination. Dr. PENNA and our servants found eggs of *Schistosomum* in specimens furnished by five pupils of the school.

17 VIII. In the morning we worked in the laboratory; in the afternoon the director of the sanitary service took us to the Hospital for ulcers where we found more than a thousand patients, almost all of them with ulcers, either common, or due to syphilis, ankylostomiasis or fuso-spirillar infection. Cases of *leishmaniosis* were rare or absent, as far as we could judge from mere sight. We ordered some specimens and combined a day for working at the Hospital. From there, we went to the leper hospital.

18 VIII. At the school we were informed that the director of the sanitary service was prevented from accompanying us, so we resolved to visit the veterinary school, established in Olinda by the order of St. Benedict. We saw the convent rich in interesting historical relics and memories and the garden with its secular trees, also the school and the hospital. There we found a horse with *osteomalacia* and a dog with *filariosis* and *sero-hemorrhagic peritonitis*.

19 VIII. Accepting an invitation from the Director, Mr. FELICIANO DA ROCHA, we visited the agricultural school in Socorro, where we saw interesting culture plants and gathered several insects as well as land and fresh water shells. Among them were a *Physa* and a small *Planorbis*, which I considered as a young and little pigmented specimen of *Pl. centimetralis* LUTZ. They were not infected.

20 VIII. We visited the lunatic asylum where I failed to find any indications of *pellagra*. We saw cases of *ankylostomiasis*, *scabies*, and an ulcer with abundant spirillae and spindle-shaped bacilli. There were some cases of *infantilism*, but we noticed the absence of *goitre*.

20 VIII. In the Hospital for Ulcers we examined 20 cases of untreated ulcers, many of the patients showing signs of *ankylostomiasis*. Many of the ulcers were due to *syphilis*, as shown by the bone lesions, which complicated them; some gave the impression of common ulcers with few bacteria. We failed to find a case of *fuso-spirillar ulcer* or of *leishmaniosis* but found 2 typical cases of *yaws* (bouba).

From Socorro we received living specimens of *Pseudolfersia meleagridis*, a pupiparous fly, common on the turkey in Pernambuco; blood slides of turkeys did not reveal any blood parasites.

In the material from the lunatic asylum and the hospital for ulcers, we discovered 2 specimens with eggs of *Schistosomum*; one of them was from a patient whose infection was refered to Palmares.

In some pools near Afogados one of the servants found *Planorbis melleus* LUTZ and larvae of *Mansonia*.

22 VIII. In the morning we worked in the laboratory, and found eggs with lateral spine in two more samples, sent from the General Hospital. In the afternoon we made an excursion to Dous Irmãos where we examined a pond with aquatic vegetation,

finding a few small *Planorbis* and also mosquito larvae and nymphae. We were not troubled by blood-sucking flies or gnats.

23 VIII. The morning was spent at the laboratory; in the afternoon we visited the old water reservoir of Beberibe. We caught adult mosquitos of the genera *Taeniorhynchus*, *Mansonia* and *Haemagogus*. There were some larvae of *Culex* and *Anopheles* but no signs of *Planorbis*.

24 VIII. In the sugar-factory of S. João near Varzea we examined two ponds, one of them in communication with the river Capiparibe, but though they looked very promising, they contained no *Planorbis*. We caught some frogs and enormous tadpoles, the gut of which was quite free from parasites, not containing even *Opalinae*. We also collected larvae of *Aedeomyia squamipennis* and of *Anophelinae*.

25 VIII. We made all the preparations for a journey to Natal.

26 VIII. We left by train for Natal and travelled all day through country which became gradually more dry, after we left the coast. In many places we saw cotton plantations. We passed the night in Guabira or Independencia, where there are two ponds. In one of them we found some very large frogs, known in the North by the name of *gia*, some *Bufo marinus* and specimens of a large *Ampullaria*; none of them contained interesting parasites. The inns, where travellers have to pass the night, are very primitive and abound in Stegomyia, making the place rather dangerous.

27 VIII, In the morning we saw the damage done by the "lagarta rosea" (larva of *Gelechia gossypiella*) to the cotton of this region. During the whole expedition we never saw plantations quite free from it. — We continued our journey and arrived at Natal, in time to visit the governor, who introduced us to the authorities of the place.

28 VIII. We visited the hospital where we found a patient with *Schistosomum*, arrived from Boa Cica.

29 VIII. We made an excursion to the lake of Estremoz, but failed to obtain a canoe. Still, we gathered two species of *Planorbis*. The first, of which we obtained numerous live specimens, was *guadaloupensis*. Of the second, *centimetralis*, we only obtained a few small specimens alive, but a large number of empty and quite bleached shells.

30 VIII. In the morning we visited the water supply and a pool near it, without finding any Planorbis; in the afternoon we went to the strand of Areia Preta and returned over very high dunes without finding anything of great interest.

31 VIII. Excursion to Ceará-Mirim. We took an early train to Estremoz, from where we went on a trolly, driven on the rails by men with poles. During the traject we examined a large number of pools and some more after arriving, but only in one of them did we find *Pl. centimetralis*, in fair number.

1 IX. We returned by train and found that one of the servants had collected some *Pl. centimetralis* and many *nigrilabris* inside the limits of the city.

2 IX. Failing to find enough material for study, we decided to proceed to Parahyba. The train stopped in Independencia for the night, giving us the chance of examining the other pond. Here we found many *centimetralis*, which were wanting in the ponds first examined. It is not at all uncommon to find such differences in fresh water collections, situated close to one another.

3 IX. During the journey we saw a good deal of cotton attacked by *Gelechia gossypiella*. We arrived early in Parahyba. After visiting the governor who received us very kindly, we went with the director of the sanitary service to the general Hospital. We noticed the comparative frequency of stones in the bladder and saw a good deal of ankylostomiasis, malaria and many ulcers of the leg. We visited the Lagoa de Baixo, which is rather shallow and covered with *Pistia stratiotes*, on which we found many *Planorbis cimex* and another small species of the same sub-genus *Spirulina*. There

were other land and fresh water shells but no larvae of *Mansonia*.

4–6 IX. I visited a new asylum for poor people and made several excursions without finding any *Planorbis*. Only in the Rio Jaguaribe did we collect a few *centimetralis* and the common black *Physa*. The rest of the time was spent in the hospitals, where several cases of *Schistosomum* were discovered.

7 IX. We took the train to Pernambuco. While Dr. PENNA with his servant went on to Pau d'Alho, Dr. LUTZ and the other servant stopped in Floresta dos Leões and walked on the line to Lagoa do Carro. On this side of the station, there is a brick-factory where they found many *Planorbis cultratus* and some *centimetralis*. In the large pond, which gave its name to the place, there were no *Planorbis*. Dr. PENNA also, found *centimetralis* in Pau d'Alho; besides the normal type, there was an orange colored variety. He also verified the existence of *Triatoma rubrofasciata*. From Lagoa do Carro we took the train to Limoeiro.

8 IX. In the Rio Capybaribe, I found numerous *Planorbis centimetralis* and *Planorbis cultratus*, in some ponds covered with *Pistia stratiotes*. They also contained larvae and nymphae of *Taeniorhynchus pseudomansonia*.

9 IX. In Limoeiro we found many *Pl. centimetralis*. Excrements found on the bank of the Rio Capybaribe were examined and two of them showed eggs of *Sch. mansoni*.

10 IX. We took an early train and spent the day and the night in Campo Grande, where we collected *Pl. centimetralis* in the rivers Tranquinhaem and Capybaribe. There were also some very large *Ancylus*. *Gelechia gossypyella* was common on the cotton plantations. We also collected specimens of *Pseudolfersia* on turkeys. The local flora is interesting. I found *Cochlospermum insigne* ST. HIL. (*Bixaceae*).

11 IX. We returned to Recife, where we attended to the most pressing business.

12 IX. In the Hospital do Isolamento we saw a patient with yellow fever who had come from Natal and slept in Independencia. We made macroscopical examinations in cases of *ankylostomiasis* from Campo Grande and places on the river Capybaribe. We also observed that *Pl. centimetralis* and its light variety offered great attraction to the miracidia of *Schistosomum mansoni*.

13 IX. I went to Jabotão taking with me a boy, infected with *Sch. mansoni*, to show a pond where he used to bathe; there we found many *Pl. centimetralis*, but failed to find any *cercaria* with forked tail. We made various studies at the laboratory.

14 IX. Excursion to the river Beberibe where we failed to find any *Planorbis*, though we found eggs of *Schistosomum* in excrements, left close to the water.

15 IX. In the laboratory we infected some *Planorbis* with the miracidia of *Sch. mansoni*; afterwards we took the train to Victoria and found many *Pl. centimetralis* and some *cultratus* in a brook which passes through the town; on its banks we found excrements containing eggs with a lateral spine.

16 IX. We took the train early in the morning and passed by Gravatá, where we noticed conditions favourable to the formation of a focus of infection. We passed the night in Bezerro, and found many *centimetralis* in the Rio Ipojuca.

17 IX. We went to Gonçalves Ferreira by a freight train and visited some places, where a patient had been infected. In the river there were many *centimetralis*. Afterwards we continued the railway journey to Caruarú, where we enjoyed a fine view from the Morro da Igreja.

18 IX. In the morning we collected many *centimetralis* in the Rio Ipojuca, which passes through the town. In the afternoon we made about 40 kilometers on horseback to the Fazenda Fortaleza near Altino; we were informed of the existence of *Triatoma megista* in the neighbourhood. Dr. CAMARA and his family received us very well and gave us valuable information.

19 IX. We went on horseback to Furna d'Agua, where we found *Triatoma* but no infected specimens, and returned to Fortaleza, the distance covered being about 13 to 14 kilometers. Afterwards we found some *Planorbis centimetralis* in an affluent of the river Una and obtained evidence of Schistosomum infection in man. Near the house there were some large breeding places of *Culex taeniorhynchus*. On the return journey we stopped at the falls of the rio Mentiroso, where there was a species of *Podostemonaceae* with larvae and nymphae of *Simulium orbitale*. The flora was rich and interesting, as the road crosses some mountain chains, where the land was less dry than in the other country we had passed through.

20 IX. We took the train to Bello Jardim, where we found *centimetralis* in some ponds and in the river Bitury. We also got some evidence of the presence of *Sch. mansoni*.

20 IX. We returned by rail from Bello Jardim to Recife.

22 to 24 IX. The weather was rainy. We worked in the laboratory, visited the hospital and got ready for a new journey.

25 IX. We took the train to Palmares where we examined the river Una up stream from the town; we collected many *centimetralis*, one species of *Ancylus* and several of *Simulium*.

26 IX We walked to the rapids at the railway bridge, where we found the beautiful flowers of a *Podostemonacea* and many larvae and nymphae of *Simulium*. Afterwards, we accepted the amiable invitation of Coronel PEDRO LUIZ PARANHOS FERREIRA, who showed us his important fazenda, in which there are some fine woods. We took a ride with him and collected some 50 *Tabanidae* belonging to about 12 species. The most common was *Tabanus (Macrocormus) oculus* which I knew from Pará; it is also very common in *Venezuela* and *Ecuador*.

27 IX. We took a freight train to Colonia, where there is a sugar factory, and afterwards the passenger-train to Guaranhuns where we passed the night.

28 IX. We left at four o'clock in the morning, and motored the 240 kilometers which separated us from the factory and settlement of Pedra, in CORONEL DELMIRO DE GOUVEIA's cars. We passed through a very arid region, where all the rivers were either dry or interrupted. In their remnants and in some ponds which still remained, we found several specimens of *Planorbis centimetralis*. The xerophytic flora was very poor, but we saw some interesting animals.

29 IX. We visited the factory and the settlement, finding both of them very interesting. In the afternoon we went by motorcar to the celebrated falls of Paulo Affonso, walking the last 3 kilometers.

30 IX. We visited the falls of Paulo Affonso. They are divided and can not be seen entirely except from a great distance, but their sight is very beautiful. The most imposing and impressing view is that from the iron stairs leading down to the engine-house, which is suspended above the last and most perpendicular fall, like a bird cage on a wall. The river, at the time of our visit, was very low and allowed us to gather some *Podostemonaceae* (of the genus *Ligea*) on which there were larvae and pupae of *Simulium orbitale* LUTZ. In another arm of the river, now dry, I found the same pupae on a stone wall, which is very unusual. It is remarkable that this species, is the only one, found in the large falls of Pirapora and Paulo Affonso.

1 X. In PEDRA we observed a small epidemic of *alastrim* (milk-pox). We examined specimens from 15 people, without finding one egg with lateral spine.

2 X. I examined and photographed a case of madura-foot. This disease, probably imported to Brazil where it is generally rather rare, seems somewhat more frequent in the State of Alagoas, to judge by some observations made in Bahia. Shortly after noon we took the train and reached Piranhas a little before 4 p. m. We hired a large

and heavy boat with its fore part roofed over; it is here called a *canoa*. We left a 6 p. m. but stopped soon because of a strong headwind and only took to the oars at 9 o'clock.

3 X, We passed PÃO DE ASSUCAR and many other places. The wind was always very strong and unfavourable. We observed no shells, no game and no fish. The night was spent on board.

4 X. We cruised all day with an unfavourable wind and arrived at night only, in PROPRIÁ, where we landed.

5 X. In the town there is a pond, now half filled up by order of the Federal Government, where we found many *Planorbis centimetralis*, containing two species of *Cercariae* with forked tail, one of them with eyes and the other showing a very deeply divided tail. There was a third *Cercaria* with a single and very long tail found in *centimetralis* which I collected in the Lagoa da Pedrinha below the town.

6 X. We went by canoe to the Lagoa de Oity, above the town, where, as in the one just mentioned, there is an extensive culture of rice. We found two species of *Bivalves* but no *Planorbis*. We collected several *Paederus*, here called *potó*.

7 X. With Dr. MOACYR LEITE, I visited the hospital and saw a patient with cirrhosis of the liver. The stools contained a large number of Schistosomum eggs, which were buried in mucus and had a white shell. The patient confessed to a taste for strong drinks, so that the influence of the parasites was uncertain. – Afterwards we took the train to Aracajú. During the journey I found the first *Planorbis olivaceus* in Murta, near to a tributary of the Rio Japaritubá.

8 X. The secretary of the Interior, to whom we had a letter of introduction, received us very well and attended to all our wishes. We collected many *olivaceus* near to the school and in a pond called Lagoa da Egoa. They contained *Tetracotylus* and *Cercariae* with simple tail, but none of *Schistosomum mansoni*.

9 X. We went by steam-launch to Larangeiras where at that time, *Planorbis* were rare and uninfected, but we found evidence of infection by *Schistosomum mansoni* in man.

10 X. In the hospital, we saw many cases of ulcers, some of them due to tertiary syphilis. Stones in the bladder were comparatively frequent. Afterwards, we searched several pools unsuccessfully and examined specimens, some of which contained eggs of *Schistosomum*.

11 X. We went on horse back to the *Colonia Agricola*, accompanied by its director, Mr. TRAVASSOS. The road crosses dunes and plains of pure sand with a very interesting vegetation. In the river POXY-MIRIM, there were some *Planorbis* which seemed to be small *olivaceus*. They contained three kinds of *Cercariae* with forked tail, one of them belonging to *Schistosomum mansoni* and the others like those of Propriá. With great difficulty we obtained a few specimens of *Triatoma rubrofasciata* in a house where they had been discovered before.

12 X. A large number of examinations, made in Aracajú, yielded a proportion of 27 to 28 % showing eggs with lateral spine. They were most numerous in the specimens obtained from a girl come from Capella. I went to the prison, where I chose twenty men from different regions, so as to obtain some information on the distribution of the parasite in this country.

13 X. In the hospital, we examined the girl from Capella, and found her spleen and liver small. Her mother infected in lesser degree had a large spleen and a small liver. We examined more pools and ponds, near to the hospital, which is rather far from the town. Only in the Lagoa da Telha did we find *Planorbis olivaceus*, some of the specimens being infected with the first stages of *Schistosomum mansoni*. Examining 22 specimens mostly sent from the prison, the eggs with lateral spine were found seven times. Taking into account that recent or slight infections may escape a somewhat superficial examination, the average proportion of infected people among the lower classes is probably more

than 1 to 3.—To-day I saw a large goitre of old standing, acquired in Propriá where no other case was known.

14—15 X. These days were spent in working at the laboratory, preparing the journey and taking leave.

16 X. We travelled by train to Bahia and spent the night in Timbó.

17 X. Before leaving, we collected many adult *Pl. olivaceus* in a small pond near to the station. Then we continued our journey through a region where *Pl. olivaceus* is found, and collected some specimens in Alagoinhas where according to Dr. MAURILIO PINTO, the shell is common. At night we arrived in Bahia.

18 X. We established our laboratory in the house of the Capitão do Porto, kindly offered to us.

19 X. We collected large *Pl. olivaceus* in the *Tanque da Conceição*; they only contained a *Cercaria* with unforked tail, and many cysts of *Schisostomum.*

20 X. Excursion to the Lagoa da Amaralinha where we found only *Pl. nigricans* LUTZ.

21 X. We examined the waterworks in Queimadas and Cabulla without finding any shells. We collected larvae and nymphae of *Simulium brevibranchium,* a species characteristical of the State of Bahia.

22 X. We worked at the laboratory.

23 X. We made a journey to Cachoeira, where we collected many *Planorbis* in the river Catinga. They seemed to be small *olivaceus* and contained the cercaria of *Sch. Mansoni* and another with unforked tail.

24 X. In the morning, we explored the river Paraguassú but found no *Planorbis.* In the rapids there grew a *Podostemonacea* with many larvae and nymphae of *Simulium orbitale.* In the afternoon we took the train to Feira de Sant'Anna.

25 X. In a well near the town, we found many specimens of *Physa* and, in a large pond, adult *Pl. olivaceus*, infected with *Sch. mansoni.* While examining several pools which were almost dry and very much exposed to sunrays, we found empty shells of the same species and very few living specimens, all of them small.

26 X. Return-journey to Bahia.

27 X. Excursion to the island of Itaparica. In the Lagoa Grande we found a few Planorbis and close by, several *Tabanidae* and many ticks. On account of the heavy sea we spent the night on the island.

29 X. We returned early and found that there was no accomodation in the Lloyd steamer, so we resolved to embark on the Itaquera. We hurried our preparations and leave taking and went on board under torrential rain.

30 X. Heavy storm at sea.

31 X. The weather improved.

1 XI. We stopped a short time only, in Victoria.

2 XI. We cast anchor in the harbour of Rio de Janeiro at 9.30 a. m.—

The following chapters are written by Dr. OSWINO PENNA:

On the frequency of Schistosomum Mansoni in the visited States as shown by macroscopical examination.

"During our journey we took notes of 312 coprological examinations. There were a good many others, of which, for various reasons, we took no notes. We give the results by order of the States in which they where made.

Rio Grande do Norte.

At Natal, we examined specimens from 25 pupils of the School of Marine Apprentices, as regards eggs of *Schistosomum mansoni.* At the General Hospital we examined specimens from 19 individuals, obtaining 3 positive results; these patients had come from the place called Boacica, where, as we were told, there is a pond containing Planorbis.

Parahyba.

We examined specimens from 25 pupils of the Marine School finding eggs of Schistosomum in 3 of them. Out of 32 patients of the Sta. Isabel Hospital there

were results in 4 cases. The bearers of these eggs had apparently been infected in the Capital and in Lagoa Grande; one of them had come from Pau d'Alho in Pernambuco.

Pernambuco.

Shortly after arriving, we examined specimens from 25 marine apprentices; 7 of them were infected by the trematode under study. We received specimens for examination from the hospital, the lunatic asylum and the alms-house. 15 out of 46 individuals contained eggs of *Schistosomum*. We also made 22 examinations of specimens, gathered at random during our journey in the interior of the State; 8 of them gave positive results. The bearers of these eggs came from the following places in the interior of Pernambuco: Bom Jardim, Bello Jardim, Limoeiro, Campo Grande, Pau d'Alho, Victoria, Bezerros, Beberibe, Gonçalves Ferreira, Caruarú, Altino, Palmares, and Jaboatão. These places are situated on the banks of the following rivers: Capibaribe, Ipojuca, Beberibe, Una and their affluents. In all these, the Rio Beberibe excepted, *Planorbis centimetralis* LUTZ was found.

Sergipe.

As usual, we first examined specimens from pupils of the Marine School; 6 out of 25 were proved to be bearers of *Schistosomum* eggs. We examined specimens from 18 prisoners with 5 positive results, and from 24 patients of the Hospital; 8 of these had *Schistosomum*. Out of 8 examinations of specimens, gathered at random, 5 showed the eggs. The places where the bearer of the adult form of this worm had stayed for some time, were: Aracajú, Japaratuba, Maroim, São Christovão, Laranjeiras, Itaporanga, Capella and Propriá. In several of these places we personally verified the presence of *Planorbis olivaceus*; some of them had been infected by the miracidium of *Schistosomum mansoni*, as was proved by their producing cercariae of this trematode. In Propriá we found morever *Planorbis centimetralis* LUTZ.

Bahia

Out of 25 oohelminthological examinations of specimens, sent from the School of Marine Apparentices, 4 were positive as regards *Schistosomum*. From the Hospital we obtained 8 different specimens, of wnich 3 contained eggs with a lateral spine. In 9 specimens, gathered near rivers and ponds containing infected *Planorbis*, we obtained 5 positive results. The places in Bahia, where the bearers of these *Schistosomum* eggs had always lived or had stayed for some time, were: Feira de Santa Anna (here we found *Planorbis olivaceus* in the Tanque da Nação), Cachoeira with the rivers Pitanga and Caquende (here we verified the presence of *Planorbis* infected by this trematode), Itapagipe and Silva Jardim.

On our first journey to Pernambuco, we went on shore at Maceió and visited the Hospital. In answer to our inquiry, as to whether there were patients suffering from amoebic dysentery we were told that there was an old and exceptionally severe case, which had defied all treatment. We asked them to send us a specimen from the patient, if possible, so that we might examine it on board. On our returning to the ship we found the specimen which was immediately examined; we failed to find any amoeba, but discovered plenty of *Schistosomum* eggs; it even showed a greater proportion of eggs than any specimen examined up to that date. We wrote several times asking for information about this patient, but unfortunately failed to get any.

Of 312 specimens examined, 71 contained eggs of Schistosomum, giving an average of 22, 75 %. Resuming these rapid and insufficient statistics of human bearers of the parasite found in the northern States visited on our journey, we have:

Rio Grande do Norte.	44	examinations	3	positive.	6,81 o/o
Parahyba do Norte.	57	«	3	«	5,26 o/o
Pernambuco.	93	«	30	«	32,25 o/o
Sergipe.	75	«	23	«	30,66 o/o
Bahia.	42	«	12	«	28,57 o/o

At first sight already, one notices the difference between the States of Rio Grande do Norte and Parahyba on one side, and the remaining States on the other, as regards the percentage of bearers of Schistosomum. On account of this we stayed only a short time in the former states and gave most of our time to the latter, specially to Pernambuco and Sergipe as more favourable to our studies and hardly investigated before. We almost expected this beforehand as the examinations of specimens furnished by the patients of the Marine Hospital, had always shown the greatest percentage of bearers of eggs of Schistosomum among individuals come from Pernambuco, Sergipe and Bahia.

None of the examined specimens was entirely free from worm eggs, excepting those from 4 members of a family, come to Aracajú only 4 months before from the South of Brazil. As to the frequency of eggs of the several species of worms found in feces, the order is as follows: 1º *Ankylostoma*, 2º *Trichocephalus*, 3º *Ascaris*, 4º *Schistosomum mansoni*, many specimens showing eggs of all 4 species; these cases we called "polyvalent".

Plague.

On arriving at Recife, we were invited to visit the Isolation Hospital of Santa Aguida, where patients suffering from dysentery were received: here we looked out for cases of infection by amoebae and Schistosomum. We were shown two cases considered suspect of plague, one almost cured and the other one much improved. From the latter, we withdrew some pus of a bubo, which on examination proved sterile; this result favours the diagnosis plague. While going down the São Francisco we were told of cases suspect of plague, in Villa Nova (Sergipe), on the banks of the same river. By very circumstancial and often repeated information, we feel sure that it really was plague, some of the cases even showing the pulmonary form. Later on, our suspicions were confirmed by information obtained from two doctors, appointed by the Government of Sergipe to study this epidemic. After our return from Rio Grande do Norte to Recife, we found in the same hospital, four typical cases of plague, in which all the circumstances justifying the diagnosis of epidemical plague, were present.

All the patients came from the same part of the city, from neighbouring houses, (where a few dead rats had been found,) except one who came from another part of the city; he had, however, shortly before passed a night in one of the above mentioned houses. It was not the first time that cases with similiar symptoms had occurred in this place. The laboratory researches also confirmed the clinical diagnosis. On our way to Caruarú in the South of the State of Pernambuco, in a place called Gonçalves Ferreira, where we looked for Planorbis and patients suffering from schistosomatosis, we were told that some kilometers away some people had died with buboes in the inguinal and axillary regions; their death was preceeded by the finding of dead rats. At first we intended to verify the exactness of this information, in loco, but gave it up, as we were told that there were no more patients.

Yellow fever.

As to the presence of yellow fever, we invariably got negative information even in Alagoas. We left however convinced, that cases of yellow fever had occurred or were occurring. From time to time, a doctor spoke to us in undecided terms of suspect cases, but immediately tried to divert suspicion by affirming that the disease was

bilious remittent fever. So we arrived at Rio Grande do Norte and went back to Recife, having obtained no reliable information as to the existence of yellow fever. Some days after our return to Recife, we again visited the Isolating Hospital in search of cases of dysentery. On being invited to see an interesting patient, we found a typical case of yellow fever, already diagnosed and conveniently protected from blood-sucking insects, or to be more exact protecting them from the patient. We followed up this case; the disease lasted four days and ended in death. This patient had come from Natal in Rio Grande do Norte, having passed the night in Guarabira or Independencia. (in Parahyba); he became ill three days after his arrival at Recife.

The patient was a Syrian, recently come to Brasil (about three months before). During our travels through these two States we heard of another case of yellow fever, diagnosed by local doctors. We believe that there is an endemical occurrence of uncharacteristical yellow fever cases, which pass unnoticed, the patients not being isolated. This facilitates the infection of Stegomyiae which, by biting not immune people, generally strangers, produce the severe forms. It is quite possible that countless patients, classified as cases of bilious remittent fever, are really cases of mild yellow fever, and that instead of being treated as important cases of common infections, they ought to be isolated as suspect cases. This may be the only way of putting an end to such bearers of virus, forming foci of infection for the transmitting mosquito.

On leaving the State of Bahia, we were informed by Dr. OCTAVIO TORRES that another case of yellow fever had been verified. The patient was a priest come from a town in the interior of Sergipe where he had been nursing a colleague suffering from symptoms, similar to those he now showed himself.

So we have endemical cases of yellow fever and a very large quantity of Stegomyiae in these northern States.

Paludism.

As to paludism, we did not observe anything little known or specially noticeable. What we saw, is already common knowledge. Cases of malaria and *Anophelinae* in every part. In some places, there were exacerbations of the endemic in the form of more or less severe epidemics. This has happened of late in Alagoinhas, in Parahyba and in Cachoeira de Paulo Affonso. We arrived with the impression that the greater part of hypoemic patients suffered from malaria, but returned convinced that two thirds of the cases of anemia are due to ankylostomiasis and one third only to paludism. Many patients had the worm in the intestine and the protozoon in the blood. We even found some patients suffering from the five most common infections which are the heaviest scourges of Northern Brasil: ankylostomiasis, paludism, syphilis, dysentery and schistosomatosis. The latter, although the mildest, is nowadays spreading at an astonishing rate.

Of all the places we visited in the North, only in the city of Propriá, on the bank of the São Francisco in Sergipe, was there anything done against this endemical disease. They were filling up a large pool, which, besides being a breeding place of Anophelinae, was full of Planorbis, infected by several species of cercariae; the same pool received all kinds of refuse.

Ankylostomiasis.

This scourge is a true calamity in the North. One may say that 85 % of the coprological examinations, made in the interior of these Northern States show the presence of Ankylostomum eggs. We feel sure that at least 70 % of the individuals who furnished this material, really suffered from ankylostomiasis while the others were only bearers.

All the clinical forms of this worm disease are met with. It is quite interesting to see how other lesions which intercurrently appear in patients suffering from this form of helminthiasis, differ from the usual form in

their course and features. It is hard to imagine what will become of these people and their offspring in course of time, if nothing is done against this disease. After visiting the interior of these four States, one feels how absurd it is to talk of ankylostomiasis in certain other regions, so high is the proportion in number and intensity here shown by this parasitical disease.

Nobody can have even a faint idea of the intensity and the extension of ankylostomiasis in these northern States, nor is any one troubling about it and few are the people in these regions, who, in all their lives have taken some antihelminthic, or who are in the habit of using sanitary installations or shoes".

Conclusion.

This number also contains a monograph on brazilian Planorbis. Later on, we hope to publish a paper on the Trematodes found in them.